FIRST ANNUAL REPORT

BOARD OF AGRICULTURE

AND DISCUSSIONS

ON

AGRICULTURAL TOPICS

State of Rhode Island and Providence Plantations.

FIRST ANNUAL REPORT

OF THE

State Board of Agriculture,

MADE TO THE

GENERAL ASSEMBLY,

AT ITS

JANUARY SESSION, 1886.

PROVIDENCE:
E. L. FREEMAN & SON, PRINTERS TO THE STATE.
1886.

REPORT.

To the Honorable the General Assembly of the State of Rhode Island, &c., January Session, 1886.

An act creating a State Board of Agriculture was passed at the last January Session of the General Assembly and designated Chapter 507 of the Public Laws, a copy of which is herewith submitted. In conformity to the provisions of that act the Board hereby submits their first annual report.

Section 1 of said act provides that the Board shall be composed of the Governor, Lieutenant-Governor, and Secretary of State, ex-officio members; two members to be appointed by the Governor, one each from Bristol and Kent counties; and one by each of the Agricultural Societies receiving bounties from the State.

Subsequently Governor Bourn appointed Alfred A. Reed, of Kent County, and W. T. C. Wardwell, of Bristol County, and the several societies as follows: R. I. Society for the Encouragement of Domestic Industry, Obadiah Brown, of Providence; Aquidneck Agricultural Society, John J. Peckham, of Newport; Washington County Agricultural Society, Rowland Hazard, of South Kingstown; Woonsocket Agricultural Society, Arlon Mowry, of North Smithfield.

The Board organized at the State House, June 22, 1885, and elected His Excellency Governor George Peabody Wetmore, President of the Board, and C. W. Smith, Secretary.

At this meeting a tender of the rooms of the R. I. Society for the Encouragement of Domestic Industry for the use of the Board for the current year for office, &c., was accepted, and the headquarters of the Board are for the present located there.

A committee of the Board has visited the offices of the Board of Agriculture of Massachusetts and Connecticut, and the Secretary has also attended the meetings of the Massachusetts and Connecticut Boards at their yearly winter meetings, and they have in other ways entered into an examination of their work and the study of the needs and promotion of the agricultural interests of the State.

At the second meeting of the Board a set of By-Laws was adopted for its government as follows:

BY-LAWS.

Adopted by the Board November 4, 1885.

SECTION 1. The officers of the Board shall consist of a President and Secretary.

SEC. 2. The Governor of the State shall be ex-officio President of the Board. He shall preside at all meetings of the Board, shall have the usual duties of a presiding officer, and shall in each year after his inauguration as Governor call the Board together for its annual meeting for organization.

SEC. 3. The Secretary shall be elected annually by the Board and shall hold office until his successor is qualified, but he may be removed from office at any time by a vote of two-thirds of the Board and another elected in his place. He shall keep a fair record of the meetings of the Board, and shall file and arrange the reports from the Agricultural Societies, and shall perform the usual duties of a Secretary, and such other duties as may be prescribed by the Board from time to time.

SEC. 4. There shall be an Executive Committee, consisting of three members of the Board, who shall be elected annually by the Board, whose duty it shall be to receive communications and to consider and prepare any business which is to be presented to the full Board. This committee shall regulate its own meetings.

SEC. 5. The annual meeting shall be held at such time and place as the President may appoint, not later than the last day of June of each year. Besides the annual meeting there shall be held in the city of Providence a stated meeting in December in each year, to be called by the President, at which meeting the report to the Legislature, which is required by law, shall be considered. Other meetings may be called from time to time at the discretion of the President, and it shall be the duty of the President to call a meeting upon the request in writing of three members.

SEC. 6. The Board may appoint from time to time a chemist to make examinations and analysis of fertilizers at a stated compensation, and it shall be

the special duty of the Executive Committee to see that the methods of securing samples for analysis are such that only fair average samples of fertilizers actually sold in our market are taken. Full reports of the results of these analyses shall be made to the Board by the Executive Committee.

The Board is aware of the many important duties entrusted to them, the chief object being the promotion of agriculture and its return to the high place it once occupied in the industries of the country.

As our State has been so largely interested in manufacturing and mercantile pursuits, the agricultural interests have been somewhat neglected, but we are glad to note that the interest in agriculture is steadily growing, and that many persons are now directing their energies in this direction who have heretofore been otherwise engaged.

The series of winter meetings heretofore held by our oldest Agricultural Society seems to have been productive of much good, and has provoked discussions among the farmers of the State that cannot fail to be of benefit to them and the industry they are engaged in. These meetings have heretofore been held solely at the expense of the Society, but the Board has appointed a committee to act with a committee of that Society and the meetings will be held jointly with it.

Ensilage is coming largely into use on the farms, and seems to have come to stay. Certain it is that wherever it is used the cattle are sleek and contented and their owners are generally satisfied with the results.

The Board have visited two farms in the State by invitation of their owners. The first farm visited was that of Mr. Henry G. Russell, in Warwick, its distinguishing feature being its extensive system of forestry.

A large acreage of this farm heretofore considered almost valueless has been turned to value and profit by setting thousands of young trees, and in a very few years there will be a forest of great value. Mr. Russell has set an example worthy to be followed by other owners of waste land in our State.

The Board next visited Mr. Alfred A. Reed's farm, also in Warwick. Here we found a farm largely if not wholly reclaimed from

wet, springy and rocky pasture land that a few years ago was of but little value as farming land, but now made to produce enormous crops. Such examples as these when brought to the attention of our people must be of great benefit in stimulating like efforts in others.

The Board, believing that the annual fairs held by the different Agricultural Societies are doing a good work in encouraging and stimulating the agricultural interests of the State, would recommend that the appropriations for these societies be increased.

Considering the great importance to the farmer, of the commercial fertilizers and the necessity of further protecting their interests, the Board recommend that the General Assembly pass an act requiring the several manufacturers, whose fertilizers are sold in our State, to take out a license therefor, the money received from such licenses to be applied to the use of the Board for expenses incurred in analyzing fertilizers.

In view of the importance of our forests, and the danger of loss by fires, the Board recommend such additional legislation in the premises as shall more effectually protect the owners of valuable forests from depredation and consequent loss. Arbor day, or a day devoted to setting out trees, has become a settled institution in some sections of the country and is made a holiday. The Board would suggest that it would be well for the General Assembly of our State to pass an act establishing an Arbor day that shall be a holiday and devoted to the planting of trees, vines and shrubbery.

Section 4 of the act creating this Board provides that a sum not exceeding one hundred dollars of the appropriation for the use of the Board may be expended for lectures on agricultural subjects. The Board would suggest an amendment to the last clause of that section as follows, viz.: "The Board may expend out of the appropriation for its use such sum, not otherwise appropriated, as it may consider proper for lectures to be given before the public on agricultural subjects.

A synopsis of the returns of the various Agricultural Societies prepared by the Secretary is herewith appended:

FINANCES OF THE SOCIETIES.

	Received of the State.	Assessments.	Received for new Members.	Total Receipts for the Year.	Premiums Awarded.	Premiums Paid.	Current Expenses.	Disbursements for the Year.	Indebtedness.	Value of Real Estate.	Personal Estate.
R. I. Society for the Encouragement of Domestic Industry	$500 00	....	$420 00	$18,366 39	$2,862 50	$2,610 75	$6,705 27	$17,532 21	$1,275 00	....	$16,363 31
Aquidneck Agricultural Society	500 00	....	....	4,644 58	978 65	776 60	2,350 85	4,328 00	13,000 00	35,000 00	316 58
Washington County Agricultural Society	500 00	....	20 00	8,702 11	1,945 60	1,938 90	....	....	6,500 00	4,500 00	....
Woonsocket A., H. and I. Society	500 00	$944 00	....	7,155 41	976 50	1,307 80	1,668 85	7,099 69	7,342 03	8,000 00	55 61

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED.

	Premiums awarded Neat and Dairy Stock.	Premiums awarded for Horses.	Premiums awarded all other Stock.	Total Amount awarded for Live Stock.	Premiums awarded for Grain and Root Crops.	Premiums awarded for Fruit and Flowers.	Premiums awarded for Dairy Products.	Premiums awarded for Honey and Preserved Fruits.	Total Amount awarded for Farm Products.	Premiums awarded for Agricultural Implements.	Premiums awarded for Inventions and Domestic Manufactures.	Premiums awarded for Fine Arts and Needlework.	Premiums awarded for Plowing.	Amount paid out for Trotting.	Number of Persons who received Premiums.
R. I. Society for the Encouragement of Domestic Industry	$967 00	$190 00	$281 00	$1,438 00	$134 00	$313 50	$17 00	$114 00	$574 50	$99 00	$200 00	$272 00	......	$1,105 00	1,103
Aquidneck Agricultural Socicty	372 75	99 00	40 25	512 00	30 65	92 20	5 00	52 75	190 60	29 00	20 00	224 45	$32 00	1,000 00	273
Washington Co. Agricultural Society	749 50	155 50	246 50	1,151 50	191 25	163 20	36 00	54 80	445 35	38 00	....	234 85	32 00	650 00	798
Woonsocket A., H. and I. Society	528 00	88 00	101 00	717 00	31 75	63 75	6 50	6 00	108 00	......	....	62 50	82 00	1,410 00	......

It may not be amiss to call your attention to the following statistics in relation to agriculture in this State taken from the United States census report of 1880:

Number of farms in the State	6,216
Average size of farms .... Acres,	103
Valued at	$25,883,079 00
Value of farm implements	$902,825 00
Value of live stock exclusive of poultry	$2,254,142 00
Number of poultry on hand June 1, 1880	269,759
Value of poultry at 30 cents each	$80,927 70

There was produced on these farms:

1,564,934 dozen eggs at 15 cents per dozen amounts to	$234,740 10
Hay .... Tons,	82,646
Cereals .... Bushels,	564,580
Potatoes .... Bushels,	606,793
Market garden products sold in 1879	$261,938 00
Orchard products "	$58,751 00
Milk .... Gallons,	3,831,706
Butter .... lbs.,	1,007,103
Cheese .... lbs.,	67,171
Wool .... lbs.,	65,680
Honey .... lbs ,	8,397

Of live stock on the farms there are:

Horses	9,707
Head of cattle	35,584
Sheep	17,211
Swine	14,121

Out of our small population there are employed in agricultural labor, either as owners of the farms or farm hands, 10,945 persons.

GEO. PEABODY WETMORE,

President State Board of Agriculture.

AN ACT CREATING A STATE BOARD OF AGRICULTURE.

(Passed April 24, 1885.)

SECTION 1. A State Board of Agriculture is hereby established, to be constituted as follows: the governor, lieutenant-governor and secretary of state shall be ex-officio members of said board; two members shall be appointed by the governor, of whom one shall be from the county of Bristol and one from the county of Kent, and one member shall be appointed from and by each of the agricultural societies which receive an annual bounty from the state.

SEC. 2. One-half of the appointed members of said board shall retire from office on the first Wednesday of March in each year. The vacancies thus occurring shall be filled by the governor or the agricultural societies as the offices were before filled, and the persons so appointed shall hold their offices for the term of two years, except that one of the members first appointed by the governor and the members first appointed by the R. I. Society for the Encouragement of Domestic Industry and the Aquidneck Agricultural Society respectively shall be appointed for the term of one year.

SEC. 3. The board shall meet at least once in each year at the State House in Providence, and may meet at such other times and places as may be deemed expedient.

SEC. 4. The board may appoint and prescribe the duties of a secretary, who shall receive for his services, out of the appropriation for the use of the board, such sum as the board shall direct, not exceeding two hundred dollars per annum. The board may expend out of the appropriation for its use a sum not exceeding one hundred dollars per annum for lectures to be given before the public on agricultural subjects.

SEC. 5. The board shall investigate such subjects in relation to improvements in agriculture and horticulture in the State as they may think proper, and may take, hold in trust and exercise control over donations or bequests made to them for promoting agricultural education or the general interests of agriculture.

SEC. 6. The board may prescribe forms for and regulate the returns which may be required of the several agricultural societies and furnish the secretaries of each such blanks as they may deem necessary to secure uniform and reliable statistics, and the secretary of the board shall in each year cause to be made out and published for distribution as full an abstract of such returns as the board may deem useful.

SEC. 7. The board shall annually in the month of January submit to the General Assembly a detailed report of its doings, with such recommendations and suggestions as the interests of agriculture may require.

SEC. 8. The sum of six hundred dollars shall be annually appropriated for the use of the board. But no member of the board shall receive compensation from the State except for traveling expenses incurred in discharging the duties of the board.

SEC. 9. Any member of said board may bring complaint for violations of the provisions of Chapter 133 of the Public Statutes without giving surety for costs; and any member of said board may enter any place where commercial fertilizers are kept for sale, and may take samples of the same for the purpose of analysis.

REPORT

OF

LECTURES AND DISCUSSIONS

ON

AGRICULTURAL TOPICS,

GIVEN UNDER THE JOINT AUSPICES OF THE STATE BOARD OF AGRICULTURE AND THE RHODE ISLAND SOCIETY FOR THE ENCOURAGEMENT OF DOMESTIC INDUSTRY,

AT THE

ROOMS OF THE SOCIETY DURING THE WINTER AND SPRING OF 1886.

STENOGRAPHICALLY REPORTED BY

MISS ANNIE LOUISE BUDLONG.

PROVIDENCE:

E. L. FREEMAN & SON, STATE PRINTERS.

1886.

COMMITTEE ON LECTURES.

1886.

W. T. C. WARDWELL,

Of the State Board of Agriculture.

WM. H. HOPKINS, OBADIAH BROWN,

C. W. SMITH,

Of the R. I. Society for the Encouragement of Domestic Industry.

FIRST LECTURE.

ON ROTATION OF CROPS.

BY C. A. GOESSMANN,

Professor of Chemistry at Massachusetts Agricultural College, Amherst.

The first of a course of lectures under the joint auspices of the State Board of Agriculture and the R. I. Society for the Encouragement of Domestic Industry, was held at the rooms of the Society, No. 128 North Main St., Thursday, January 14th, at 2 P. M. Mr. C. W. Smith, Secretary, opened the meeting in the following words:

"I have been requested to call this meeting to order by the Committee of Arrangements, and to announce that this is the first of a series of meetings to be held here every Thursday afternoon for the discussion of such subjects as will interest most of you. The next lecture will be next Thursday afternoon by Mr. Edmund Hersey, a member of the Massachusetts State Board of Agriculture, on the "Cultivation of Potatoes." I will say for Mr. Hersey that he has made an experiment covering a series of six years, I think, on the planting of potatoes, with especial objects in view, which he will explain to you when he comes.

"The third lecture will be by Prof. Stockbridge of Amherst, Mass., and will be followed by other meetings, one of which will be devoted to the interests of bee culture.

"I am requested to ask Lieut. Gov. Darling to take the chair and preside during the rest of the meeting."

LIEUT.-GOV. DARLING. — Gentlemen of the society, it is hardly necessary for me in introducing the speaker who is to address you this afternoon to make any extended introductory remarks. He is well known to most of you as one of our leading chemists in this section of the country, and also has had more practical experience than almost any other man you could hear. The subject on which he will address you is the "Rotation of Crops."

PROF. GOESSMANN.

The practice of raising upon the same lands, for any length of time, in succession, the same variety of plants, or crops of a similar character, has proved ultimately disastrous everywhere. It is an old observation in agriculture that a given area of land produces, in the majority of cases, more satisfactory crops when planted from year to year with a different kind of plants; and it was not less understood in ancient times, that one series of crops raised in succession gave better returns than another.

The beneficial influence of a periodical rest in the cultivation of farm lands, as far as their productiveness is concerned, was also recognized at an early date. Ancient writers on agricultural topics speak highly, and not infrequently very intelligently, of the good services of fallow in the management of farms; they point out why gardeners, on account of the great diversity of crops they raise, and of a more thorough mechanical treatment of the soil they cultivate, feel less the necessity of fallow, than farmers engaged in the raising of a few grain crops.

Comparing many of our customary modes of treating our lands with a view of promoting their fertility, with those in use for a similar purpose in more remote ages, we find that they are time-honored, and not unfrequently of hundreds and even of thousands of years standing. The merit of having introduced into the agricultural practice of to-day irrigation, underdraining, fallow and subsoiling, in the interest of an economical development of the inherent or latent sources of fertility in the soil under cultivation, has been duly credited to preceding centu-

ries; the same circumstance may be justly asserted with reference to the introduction of a rotation of crops, and of the cultivation of deep-rooting and foliaceous forage plants, for the purpose of economizing advantageously various resources of plant food. Careful observation in the field, and actual trials carried on through ages, have steadily added to their appreciation, in farm practice, and contribute much towards a judicious decision regarding the most advisable course of operation to meet efficiently local circumstances and special requirements.

Whilst we thus have to yield to previous centuries these points in regard to our present farm practice, we can assert with not less certainity, that during our present century much more progress has been made in recognizing the principles which underlie the previously mentioned modes of operation in farm management, than during all preceding periods in the history of agriculture. Their well-known failures in preceding ages were in a controlling degree due to a want of means to gain a deeper insight into their peculiar mode of action. The mere statement of the fact that the chemical composition of the water and of the air became only known at the close of the past century, and that a proficiency in ascertaining the constituents of soil and of plants could only be claimed by comparatively few chemists even as late as 1830, will suffice to show the possibility of the times.

The important bearing of these circumstances on the contemporary conditions of agriculture is to-day so well recognized that we expect to meet an unqualified endorsement when we assert that the attainment of more satisfactory results in our agricultural industries of to-day, aside from improvements in agricultural implements, is mainly due to a better knowledge concerning the composition and the general characteristics of the air, the water and the soil, and the relations of these agencies to plant life, besides a more correct appreciation of the mutual dependence of an economical production and support of plants and animals, in an ordinary mixed farm management.

The progressive farmer of the present generation has greatly improved his chances of success by calling, for assistance in his varied and complicated field of industry, on the scientific investigators in every depart-

ment of natural and physical science. The best experimental resources of to-day serve as his guides.

He understands it well, that although it is an undeniable fact that horticulture was for ages recognized as a highly developed art, before botany deserved the name of a science, that the latter has rendered of late most valuable services regarding a more correct understanding of the phenomena of plant life in general, as well as the particular relations of important families of farm plants to each other in farm economy; and he is not less prepared to concede that although barn-yard manure, wood ashes, salt, gypsum, marl, lime and bones were known as manurial substances to writers on agricultural operations of ancient Rome, that modern agricultural chemistry has thrown a new light upon the subject of the fertilization by these means, showing their true relation to the chemical and physical conditions of the soil which receives them, and to the crops raised upon it, and reducing the entire question of an efficient manuring of our lands to the one principle,—"restitution."

We recognize to-day, as the basis of a successful cultivation of farm crops, the necessity of restoring to the soil those of its constituents which the crops raised upon it have abstracted.

To prove the existence of these relations, and to show how to comply with their requirements, is the work of scientific investigators of a more recent date. The results of these investigations, which are still going on in the present, do not directly antagonize any particular system of farm industry; they furnish, on the contrary, in many instances, a safer guide for farmers to choose a branch of agricultural industry, and a system of cultivation best adapted to their local and personal resources. All are, however, subjected to one common rule, as far as the successful cultivation of farm crops are concerned,—they have to comply with the unalterable relations which exist between demand and supply; for each kind of crop, although in its own way, tends to exhaust the soil sooner or later. Rotation of manures has to a considerable extent lessened the necessity of a rotation of crops, and modified the selection of crops for an economical system of cultivation.

The early history of agriculture points everywhere towards two distinct systems of industry; namely, the cultivation of grain crops, and the raising of animals for the production of food for the support of the human family. Both systems, at first more or less independent of each other, subsequently merged gradually into one, in most localities, and laid thereby the foundation to the most extensive system of agricultural industry,—the mixed farm management.

Increase in population, progress in civilization, diversity of soils and climate, local demands of markets, personal fitness and pecuniary resources of farmers, have been instrumental in the development of quite a number of more or less reputed systems of farm practice, to meet the requirements of the times. All existing systems of agricultural industry of to-day differ mainly in regard to the following circumstances: *First*, the exact period when fallow shall return, or whether it shall be entirely discarded in the management of the lands under cultivation; *second*, the mode of securing the needed fodder for the farm live stock,—whether it is to be supplied entirely or in part by pastures and natural meadows, or by raising additional fodder upon cultivated lands; and, *third*, the particular order in which the various crops selected for the special industry carried on are to succeed each other upon the lands assigned for that purpose.

The older systems of farm practice, still in use in localities less advanced in agriculture, rely in a great measure on a frequent recurrence of fallow, as a means of recuperating fertility in a more or less exhausted soil; those of a more recent date depend less on development of inherent dormant soil resources of plant food by natural or atmospheric agencies, but supplement them more or less by additions of suitable plant food, in form of commercial fertilizers, or indirectly by buying fodder for the farm live stock, to replace, in an economical way, those soil constituents which have been sold from the farm in the form of crops. As most of the older systems of farm management are either obsolete or still confined to only a limited area, and thus, in the majority of cases, largely of a mere historical interest, a farther detailed discussion will be omitted.

A system of raising farm crops can only then be called a rotational one, in the light of our present experience, when it tends to secure the production of the largest amount of valuable vegetable matter at the lowest possible cost, in connection with a due attention of returning to the soil those of its constituents, in a suitable form, which the crops raised upon it have abstracted. To attain this end in a measurable degree, imposes the compliance with two important conditions ; namely, a successful adaptation to soil and climate of the crops selected for the special farm industry, and remunerative market prices for the products obtained.

Considering these two conditions of success equally applicable to all branches and special systems of agriculture, it becomes quite obvious that on account of the great difference in local and personal resources, no one definite rule can be laid down for either the selection of the best adapted system of farming, nor for the best arrangement of the succession of the various crops chosen, which promises to be the best under all circumstances ; there are no unfailing receipts on these points.

Taking this view of the subject under discussion, I propose to relate in a few subsequent pages some of the more recent scientific inquiries into the principles which underlie a successful application of well-known and reputed agricultural modes of operation, and their relation to a remunerative rotation of crops.

Fallow. — One of the oldest modes of maintaining the productiveness of lands is known by the name of fallow. This name, has been applied, however, in the course of time, to so widely differing treatments of the soil, that it seems desirable, in the interest of a judicious decision concerning its claims for a consideration in this connection, to describe shortly the management of fallow land, from its first introduction down to the present time.

Judging in particular from writings on agriculture of ancient Rome, we notice that it was originally applied to cultivated lands, which were left for one entire year,—from autumn to autumn,—*unseeded*, whilst the soil was turned over directly after harvesting the last crop, and during the succeeding summer season repeatedly ploughed and har-

rowed before seeding it down again. The period for that treatment of the soil recurred in different localities and at different times, at intervals of from one, two or three years; the three years' course, with one year of winter grain and one year of summer grain, in rotation, it is stated, became already quite prominent in the agricultural practice of Europe during the ninth century; and it has come down to our time in some localities, on both sides of the Atlantic, with but little modification. Wherever that treatment of the soil gradually failed to secure, in a satisfactory degree, a frequent production of remunerative grain crops, the fallow time was extended over several years, and frequently a growth of natural grasses allowed to cover the lands. The latter were left unploughed, and served quite frequently for pastures; yet the lands thus treated were commonly called "fallow lands" and the pastures "fallow pastures."

This system of farming was continued until, in consequence of an unrestricted production and sale of grain crops, the natural resources of the fertility of the soil became exhausted; and as long as new lands at low cost enabled a repetition of the operation. A scanty production of manure was the inherent cause of its ultimate universal failure.

The unremunerative character of a frequent recurrence or long duration of fallow made itself, quite naturally, first felt near centers of a denser population, where an increase in the price of land called for changes.

The first step, or real progress, is marked by the introduction of *manure* into fallow lands. The period of fallowing was reduced to one season, and the manure thoroughly distributed in the soil by repeated ploughing and harrowing. The area allotted to grass lands was subsequently greatly enlarged, and thereby the chances of keeping more live stock efficiently improved. As long as the meadows held out, the new shift succeeded well; as soon, however, as the grass lands began to fail in producing good crops, a scarcity of manure made itself felt again, and a new change of the system became advisable.

Fallow lands were subsequently made to produce, during part of the year, either some suitable crop,—summer grain, etc.,—to serve as

green manure by ploughing it under, or some less exhausting fodder crop, as beans, pease, vetches and clover, to furnish more fodder and subsequently more manure; thus were introduced green fallow and fallow crops.

The system of fallow as originally applied, was evidently introduced for the purpose of improving the mechanical and general physical conditions of the soil; for the destruction of obnoxious weeds and insects; and for an increased preparation and accumulation of inherent resources of fertility to secure better crops. The beneficial influence of repeated ploughing, etc., on the mechanical condition of a heavy, clayish soil, in particular, is to-day still recognized, and, in some exceptional cases, stlil considered indispensable for a successful cropping; not less is still appreciated its good services for the retention of moisture.

As a means for an increased production of available plant food, by the disintegration of soil constituents, it is only of interest in the case of naturally rich soils; for experience has fully demonstrated the fact that growing plants, by their root system, act more powerfully in disintegrating the soil, and liberate more plant food, than the ordinary agencies of the atmosphere, as carbonic acid, oxygen, water, and changes of temperature, when acting on tilled yet unseeded lands. The destruction of obnoxious weeds is to-day surer attained by close cultivation, drill culture, and by the introduction of hoed crops in our system of farm practice.

The fallow system is, in the majority of cases to-day, too costly to deserve an unqualified recommendation; it is excusable only where manure in sufficient quantity cannot be obtained at a remunerative cost, or where the character of the land is such that manuring does not pay.

We recognize fully the importance of a naturally good soil, and concede that the natural and inherent yet still inactive resources may be made, by proper treatment, quite frequently valuable helpmates for the production of crops; yet they have proved ultimately insufficient to produce remunerative crops for any length of time, without the assistance of outside supplies. The endeavor to save the best feature of the

fallow system led gradually to the development of the system of a rotation of crops.

Rotation of Crops.—Experience in agriculture teaches that most of our farm crops, even when properly manured, cannot be raised upon the same lands for any length of time, in succession, without a gradual decline in the annual yield, and an ultimate entire failure. The soil becomes for some reason or another, unfit for an economical reproduction of the same plant. The exact time when this circumstance happens must vary, quite naturally, widely; for soil, climate, more or less thorough system of cultivation, as well as the general character of the plant, each in their own way bear on the final result. Potatoes have been raised, without any interruption, upon the same lands upon Helgoland, since their introduction in 1806. Wheat follows upon wheat for ages in Egypt. The same is true in regard to rice in China; to corn in Mexico, and to barley in some localities in Greece. However interesting the reports concerning these statements may be considered, they do not change the force of the above verdict of experience.

Taking our information from past ages, we notice the fact, that as a rule, the more limited the varieties of plants selected for a system of farming, the sooner did the industry become unremunerative.

A comparison of the results obtained from lands of a corresponding general character, engaged in the raising of a variety of garden crops, with those used for the production of a few grain crops, suggested already, at an early date, the idea that the comparative continued success in raising a large variety of garden crops, in sight of a more frequent failure of a few grain crops in the contemporary system of farm management, could not be due to the operation of different laws of nature, but might be the result of a more careful mechanical preparation of the soil in garden farming, and the raising of a greater variety of plants, requiring different conditions of the former for their successful growth.

The attempts to select additional new crops, best adapted to the existing local conditions of soil, climate and the contemporary demands of the markets, led, in the course of time, to a variety of systems of

cultivating more or less kinds of crops in some definite, regular succession, upon the same lands, and repeating that course in the same order, over again, with more or less success.

Thus we find at first a two-years field course,—one year summer or winter grain, with one year fallow. Subsequently, a three-years field course,—first year, summer grain; second year, winter grain, with manure; third year, fallow, with or without manure. Still later on, we find a substitution of fallow by fodder crops or hoed crops, or by cultivating both together, with summer and winter grains. The introduction of clover and potatoes mark here a new era in agriculture.

The reputed original four-years "Norfolk course, which consisted of —

First Year. Root crops (turnips, rutabagas, etc.);
Second Year. Summer grains (barley, etc.);
Third Year. Fodder crops (leguminous plants, clover, etc.);
Fourth Year. Winter grains (wheat, etc.);

belongs here.

With an increasing development of a more intensive system of farming, and a better appreciation of stock-feeding as an important factor for the improvement of farm lands, even more prominence has been given to other than grain crops, assigning to them, in some instances, two-thirds of the entire area of lands under cultivation. In some reputed systems of rotation does the course, upon one and the same piece of land, extend over ten or more years.

As each system of rotation of crops, if intelligently worked out, rests its claims of particular merits, as compared with others, on a careful consideration of local resources and conditions, but little interest can be aroused by discussing their respective advantages on an occasion like the present, where a limitation of time excludes the presentation of such details of facts as would be desirable to arrive at judicious decision regarding the subject under consideration; besides, elaborated systems of rotation of crops, covering a series of years, are mainly of interest and of particular benefit in case of large estates.

It is for this reason in particular, that I do not undertake the task of describing more in detail some of the many systems of rotation which have acquired a local, and, in some instances, even a national reputation, but propose to discuss shortly some of the causes why a rotation of crops tends to increase the chances of rendering the raising of farm crops more successful, and thus more remunerative, than any of the older systems of field management; and to conclude with a few suggestions of a practical character regarding a proper order of succession of farm crops, gathered from experience on well-managed farms here and elsewhere.

The causes why many of our prominent farm and garden crops may be raised with a better prospect of success upon the same lands by adopting a well-considered course or order of succession, rests mainly on the fact that it presents a better chance to regulate the chemical and physical conditions of the soil, with reference to the kinds of crops to be raised; for a judicious system of rotation assigns to each crop that position in the course decided upon which promises to benefit most by the existing conditions of the soil. It aims at an economical application of the natural resources of plant growth in soil and atmosphere, by alternating the crops with reference to both. Crops are following each other, not only with reference to one year's result, but also with a view of improving the general condition of the industry adopted.

To attain this end with a fair prospect of success, we have to make ourselves, as far as practicable, familiar with the following points:—

1. Relations of the mineral constituents of the crops to the composition of the soil. 2. Relation of the botanical characteristics of the plants to the composition and physical condition of the soil. 3. The character of the manures at our disposal.

1 *Relations of the mineral constituents of the plants to the composition of the soil.*

All our cultivated plants require for their growth the same soil constituents; they differ, however, decidedly, not only in regard to the

absolute amount which they abstract, but also in regard to the relative proportion of the same essential elements. Boussingault found, by actual observation, that upon the same field (2.5 acres), by one manuring, in five succeeding years, the following quantity of soil constituents had been abstracted :—

First year, Potatoes (without stems)	246.8	lbs.
Second year, Wheat (grain and straw)	371.0	"
Third year, Clover	620.0	"
Fourth year, Wheat (more straw)	488.0	"
Fourth year, Turnips	108.8	"
Fifth year, Oats (grain and straw)	215.0	"
Total	2,049.6	"

(The difference of 117 pounds of soil constituents between the first and second wheat crops is explained by the larger amount of straw as compared with the grain.)

Under similar conditions an average crop of beet roots, without leaves, had abstracted 399.6 pounds of soil constituents; peas (with seed and straw), 618 pounds of soil constituents; and rye (grain and straw), 284.6 pounds of soil constituents.

Dry stems and leaves, as a rule, contain several times more ash constituents than the grains and fruits of the same plants; young plants contain usually much larger quantities of ash constituents in proportion to their organic matter than in their matured state.

One thousand parts of air-dry vegetable matter contain, in the case of meadow hay, from 45 to 65 parts mineral soil constituents; clover hay, from 45 to 80 parts mineral soil constituents; grain crops (seeds), from 12 to 20 parts mineral soil constituents; grain crops (straw), from 40 to 50 parts mineral soil constituents; root crops and potatoes (without leaves), from 6 to 10 parts mineral soil constituents; tobacco (stems, dry), from 60 to 70 parts mineral soil constituents; tobacco (leaves, dry), from 140 to 150 parts mineral soil constituents.

One hundred weight parts of the mineral constituents of the following important groups of farm plants contain, on an average, alkalies,

lime, magnesia, phosphoric acid and silicic acid, in the following proportions :—

		Alkalies.	Lime.	Magnesia.	Phospo-ric Acid.	Silicic Acid.
Grain crops: wheat, rye, oats, etc,	Grain,	30	3	10	50	-
	Straw,	20	5	2	3	60
Leguminous plants: pease, beans, clover, etc.	Seeds,	45	5	8	40	-
	Straw,	30	35	8	10	5
Hoed crops: roots (or tubers)........		60	3	5	15	10
Potatoes, etc. (leaves and stems),....		25	40	3	3	20
Root crops (roots)......		50	10	3	10	5

The amount less than one hundred per cent. consists of iron, chlorine and sulphuric acid. The fact that these constituents are liable to vary within certain limits does not interfere with the purpose for which they are stated above.

The relation of phosphoric acid to potassa are in the following crops as subsequently stated (in average crops) :—

	Potash.	Phosphoric Acid.
Wheat Grain	1	1½
Wheat Straw	2	1
Potatoes	3	1
Sugar Beets	4	1
Fodder Corn..	4	1
Indian Corn (grain)	1	1½
Clover Hay..	3½	1
Meadow Hay	4	1
Tobacco..	5–7	1

Table showing the quantity of fertilizing material removed by the seed, stem and entire plant of various crops. (For Massachusetts.) [According to Wolff.] (Based on the average crop for 1871.)

CROP.	Average yield per Acre. Pounds.	Substances removed by the foregoing Crops, from One Acre (in pounds.)			
		Water.	Nitrogen.	Potassium Oxide.	Phosphoric Acid.
Corn—Seed	1,920.80	261.23	30.73	6.34	10.56
" Stalks	5,122 13	717.10	24.58	85.03	19.46
" Total	7,042.93	978 33	55.31	91.37	30.02
Wheat—Seed	1,092.00	156.16	22.71	6.00	8.95
" Straw	2,275.40	320.83	7.28	11.15	5.23
" Total	3,367.40	476.98	29.99	17.15	14.18
Rye—Seed	1,008.00	150.19	17.74	5.44	8.26
" Straw	2,352.00	354.41	5.64	17.87	4.42
" Total	3,360.00	504.60	23.38	23.31	12.68
Oats—Seed	1,004.80	140.67	19.29	4.22	5.52
" Straw	1,507.20	212.52	6.03	11.62	2.71
" Total	2,512.00	353.19	25.32	18.84	8.23
Barley—Seed	1,161.60	168.43	17.65	5.57	8.36
" Straw	943.80	132.13	4.53	8.78	1.79
" Total	2,105.40	300.56	22.18	14.35	10.15
Buckwheat	720.00	101.52	10.37	1.51	3.17
Potatoes—Tubers	7,560.00	5,670.00	24.19	42.33	13.60
Tobacco—Leaf	1,450.00	261.00	50.20	78.44	10.29
Hay—Total	1,920.00	276.48	25.15	32.83	7.87

As the rotation of crops is based on the facts that each plant under cultivation has its lowest limit for every article of plant food to succeed well, and as not two species of plants do correspond exactly in that respect with each other, it becomes quite obvious that analytical numerical statements like those above can assist as a valuable helpmate in arranging our farm crops in an advantageous order in any system of farming.

Considering, for instance, the previously stated numerical relations of phosphoric acid and potassa in the mineral constituents of several prominent farm crops,—meadow hay, fodder corn and beetroot,—we find that they contain, practically, both constituents in the same relative proportion; namely, four parts of potassa to one of phosphoric acid.

Assuming for the sake of illustration, that the soil which shall serve for the experiment contains its available phosphoric acid and potassa in a similar proportion (1 : 4), the cultivation of these three crops must render the soil poorer in both constituents, and render the latter, sooner or later, entirely unfit for their remunerative reproduction.

Quite different would be the result in case potatoes or some leguminous crop,—as clover, pease, beans or vetch—had been raised as first crop upon that soil. In that case its phosphoric acid would be abstracted in a larger proportion than its potassa; it would grow thus richer in potassa, and might serve subsequently well, if otherwise fit, for the raising of tobacco, On the other hand, if tobacco had been the first crop, phosphoric acid would have increased in proportion, and the potassa been reduced. Under these circumstances, a grain crop would be a safer crop to succeed than either fodder corn or grass,—except an additional supply of potassa was secured from some outside source to restore the desirable relative proportion between phosphoric acid (one) and potassa (four).

The fact that a one-sided exhaustion of the soil is a quite prominent source of the failure of crops was noticed during the past season in connection with some field experiments upon the grounds of the State Agricultural Experiment Station at Amherst. A short description may not be without some interest on this occasion.

In one instance, a piece of worn-out grass land, which for several years past had not produced as much as one-half of a ton of hay per acre, the grass dying out prematurely in the last year, was to be added to a series of experimental plats with an excellent mechanical condition of the soil, without adding any manure from outside sources. To secure a mechanical uniformity of the soil between old plats and new addition of land, the old, worn-out grass land was ploughed early in the spring, thoroughly harrowed, and at once seeded down in drills, in part with horse bean and in part with white lupine. Both crops being kept clean by means of a cultivator, proved a remarkable success, and formed a marked contrast to the previous grass crop.

Another interesting illustration of the influence of raising one and

the same crop upon the same land, on the quantity and quality of available plant food of the latter, was furnished in connection with experiments upon the grounds of the Experiment Station to test the retentiveness of the soil with reference to, single articles of plant food, —as phosphoric acid, potassa, and various forms of nitrogen.

A piece of underdrained land, previously kept for years in grass, which had been subdivided in eleven plats, each one-tenth of an acre in size, was for three preceding years planted with fodder corn, without using manure of any description.

During the past season three plats received a fair amount of a nitrogen compound as fertilizer. One of these received sulphate of ammonia; another one (Chili saltpetre), nitrate of soda; and the third one, blood. The actual amount of nitrogen was the same in each case. A fourth plat received a fair amount of soluble phosphoric acid in the form of dissolved bone-black; and the fifth and sixth plats received each corresponding amounts of potassa in the form of either muriate of potash or sulphate of potash.

These six plats were separated from each other by plats of an equal size which had not received a fertilizing material of any description for four years. Alongside of that piece of experimental plats was planted a field of fodder corn of the same variety as upon the former. It was well manured with barnyard manure, supplemented by commercial fertilizers, to secure a good crop. The seed corn being one and the same lot, proved to be good; the young corn started well; yet soon a decided difference became noticeable between the growth of the plats fertilized with nitrogen in various forms, and with phosphoric acid, on one side, and the two plats fertilized with potash compounds on the other. The former did not differ from the unfertilized plats at the close of the season. None produced well-developed ears. There was no marked difference in their final yield. The two plats fertilized with potash salts alone looked healthy and vigorous throughout the entire season, and yielded a fair average crop. It compared at any time well with the crop upon the well-manured fields in its vicinity.

This result shows plainly that more potassa was mainly wanting, in

our case, to secure a satisfactory crop; and it furnishes also a good illustration of the fact that, under otherwise corresponding circumstances, one of the essential elements of plant food requires the closest attention in our system of manuring, which is most liable to become deficient in the soil, either in consequence of an excessive demand on the part of the crop we raise, or on account of the slow supply from inherent soil resources.

An unrestricted cultivation of grain crops, accompanied by an extensive sale of the grains from the farm, brought the phosphatic fertilizers (superphosphates, etc.) in popular favor; and an increased production of fodder and hoed crops, as well as garden crops in general, has given of late a deserved prominence to potash compounds as a valuable manurial substance.

2. *On the relation of the botanical characteristics of our cultivated plants to the chemical composition and the physical condition of the soil.*

The chemical analysis of our cultivated crops gives us, as has been shown in previous pages, an insight into their action on the constituents of the soil; yet, however important this information must be considered, it is but the first step towards a safer basis for deciding the most advantageous order of succession regarding the crops chosen for cultivation.

The natural qualification of the plants to appropriate their food from soil and atmosphere, as well as the time required to reach the desired state of maturity, are points of not less importance to consider in this connection.

On Root-System.—Plants with an extensive root-system, either in lateral or horizontal direction, or both, are better qualified to secure their essential mineral constituents from the soil than those with a limited one. The frequent observation in practice, that, of two crops which require the same essential mineral constituents in a similar proportion for their growth, one yields still a good crop when the other one fails, finds, quite frequently, its explanation in this circumstance.

Potatoes may still prosper where beetroots fail, and rye yield still a satisfactory crop where the raising of wheat does not any more pay; although in both instances are required a similar amount of essential mineral constituents. Potatoes develop an extensive root-system in the upper layer of the soil, whilst the beetroots, like all our root-crops, feed largely upon the subsoil.

On the other hand, the root-system of the wheat is compact and consists of fine root branches, whilst that of rye is loosely constructed and extends through a larger body of soil.

These circumstances explain the well-known fact why wheat prospers best on a compact but rich soil, whilst rye is less exacting with regard to the character of the soil, whether heavy or light; although an average crop of rye abstracts, under corresponding circumstances, usually a larger amount of potassa and phosphoric acid, with an equal amount of nitrogen, than an average crop of wheat.

The examination into the structure and the extension of the roots of our farm plants, has given most valuable suggestions in regard to an economical system of rotation.

The advice given by experienced farmers, to raise wheat direct after deep-rooting leguminous plants,—as clover, luzerne, serradella, vetch, pease, beans, cow pea, etc.,—and as a rule not after hoed crops,—as potatoes or roots,—is in full accordance with the chemical and botanical characteristics of that plant. Hoed crops, if early enough harvested to allow the seeding down of winter grains, are apt to leave the soil too loose for wheat, and thereby increase the danger of winter-killing.

Deep-rooting plants, in consequence of their extended root-system, abstract largely their food from the lower strata of the soil, and carry it to the upper layers. They tend to enrich the latter at the expense of the former. It is for this reason but natural that hardy feeders, with a shallow root-system, like most of our grain crops, should follow first in order after the cultivation of deep-rooting plants.

Aside from this result we notice, also, that they exert directly a beneficial influence on the entire body of agricultural soil within reach

of their roots. The latter, by penetrating into the subsoil, expose it to the influence of the atmospheric agencies, as ogygen, carbonic acid and germ activity, and favor thereby the production of additional plant food. The decomposition of a comparatively large quantity of vegetable matter left upon the field in the form of stubble and roots, as well as the reaction of the agencies of the air on the newly opened subsoil, tends to raise the temperature of the entire soil.

Both chemical and physical properties of the latter are benefited usually in such a degree, that we quite properly look upon this class of plants as most valuable helpmates for an economical cultivation of farm lands.

The subsequent tabular statement is not without interest in this connection :—

Weiske's Statement in regard to Root and Stubble Refuse left in the Soil by the following Crops.

CROP.	Roots and Stubble.	Mineral Matter (and Earth)	Organic Matter.	Nitrogen in Vegetable Matter.	Lime.	Magnesia.	Potash.	Soda.	Sulphuric Acid.	Phosphoric Acid.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Rye, ...	4,830	1,512	3,400	62	69	14	30	40	12	24
Barley, . . .	1,827	350	1,515	22	40	5	9	3	5	11
Oats, ...	3,467	1,325	2,200	25	81	12	24	17	8	28
Wheat, . . .	3,200	1,000	2,240	22	72	10	17	11	7	11
Buckwheat, . .	2,015	427	1,630	45	75	7	9	4	6	10
Pea, ...	2,960	616	2,400	53	68	11	11	7	9	14
Lupine, . . .	3,250	506	2,800	58	76	12	16	3	7	13
Red Clover, . .	8,186	1,762	6,580	180	246	46	77	19	24	71
Luzerne, (alfalfa)	8,870	1,104	7,770	125	181	22	24	25	17	36
Cultivated saint-foin, ...	5,442	940	4,500	113	108	29	39	13	19	28
Seradella. . .	2,872	500	2,371	60	74	13	8	5	9	14

(Statement applies to one acre.)

In recognition of the importance of deep-rooting plants for the economical production of farm crops, as well as valuable fodder plants, a series of experiments has been introduced at the State Experiment Station to test the adaptation of some new varieties to our soil and climate. (See First and Second Annual Reports of Mass. Experiment Station.)

On Leaf-System. — As the leaves of plants stand in a similar relation to the assimilation of the plant food of the atmosphere (oxygen, carbonic acid, and some nitrogen compounds) as the roots to those of the soil, it is but judicious to take also into consideration the leaf-system of our cultivated plants, when selecting crops for a rational order of rotation. Plants with an extended leaf surface absorb more atmospheric plant food than those with a small and limited leaf growth; their cultivation tends to enrich the soil with nitrogen compounds and humus.

Broad-leaved and foliaceous plants of the two great families of Leguminosæ (clover varieties, pease, beans, vetch, lupine, etc) and of Cruciferæ (mustard family, beetroots, turnips, cabbage), besides representatives of others, as potatoes, carrots, parsnips, corn, sunflower, etc., absorb more from the air than our grain crops, and can therefore better depend for their supply of nitrogen on that source than the latter. They are good crops to precede grain crops in rotation, although they contain usually a much larger amount of nitrogen in their annual crop than the latter, on account of the larger weight of the annual yield of vegetable matter.

Broad-leaved plants improve also decidedly the physical condition of the soil they are raised on; they shade the land against the hot rays of the sun during the day in the summer, and retard the loss of heat by radiation from the soil into the air during the night, regulating thereby the atmosphere of the former in the interest of a successful growth. They economize the moisture of the soil by reducing the chances of evaporation, — a circumstance which protects these crops not only against the serious influence of a drought after they are once fairly under way, but leaves the soil in the best possible condition for the succeeding crop, as far as its state of moisture is concerned.

Well-regulated summer heat, in the presence of a moderate amount of moisture, and a free access of air, are most powerful agents for a rapid disintegration of the vegetable matter of the soil. Adding to these valuable features the fact that well-shaded grounds, in consequence of a close cultivation, assisted by a frequent use of the cultivator or the hoe, as circumstances may advise, are known to be most efficient means to subdue the growth of weeds, it becomes quite obvious that their introduction, in the course of rotation, directly after winter or summer grain crops, or crops which in a similar degree favor the development of a foul growth upon cultivated lands, deserves, for various reasons, high commendation.

Having briefly discussed the importance of the character of the roots and leaves of our farm plants in an economic system of rotation, it remains for me to call, in this connection, also, attention to the duration of growth as an important point deserving a serious consideration in the management of farm land.

Some of our farm plants pass through the various stages of plant life from germination to the maturing of the seeds in one season; some require for the same purpose two seasons; others produce flowers and seeds for several years in succession. Some crops are gathered after the seeds are matured (grain crops), others before blooming, (root crops, etc.,) and others furnish crop for more or less years, by sending up new shoots or branches. Close investigations into the requirements of plant growth, have shown that plants do not only differ from each other in regard to the absolute and relative quantity of the same essential articles of plant food, but also in regard to the period of growth, when more or less of one or the other is needed.

Plants which are but short-lived or reach their maturity within a few months, require, for this reason, a soil rich in those constituents which are essential for their normal development; plants which need from five to six months to pass from seeding down to the harvesting of their seeds, are better fitted to benefit by the supply of plant food from the natural resources of soil and of air, than those which reach their maturity within three months after seeding.

Summer grains on one side, and grass lands, orchards and forest on the other, represent the extremes in this direction in our farm industry. Grain lands respond better to a liberal manuring than grass lands. Lands well adapted to a grass growth necessitate the smallest expenses for manure to return remunerative crops, — a circumstance which imparts to natural meadows a particular value in farm management; they not only turn the natural resources of plant food to the best account, but can aid in the production of home-made manures to benefit all parts of the farm. This consideration leads us to a short discussion of the third point mentioned as worthy of a careful attention when planning a course of rotation of crops.

3. *The character of the manures at our disposal.*

The investigation into the composition of the plants we cultivate, and their relations to the chemical and physical conditions of the soil which has served for their production, has thrown, as we have noticed, a new light upon the question: How can we promote most efficiently, in an economical way, the production of field and garden crops?

We have learned by actual tests that the best results, in growing plants of any description, are obtained by providing a liberal supply of every essential article of plant food at the time when needed for some physiological function in the life of the plant under cultivation. To meet the periodical wants of the plant is a first condition of success.

Grain crops require, in particular, phosphoric acid and nitrogen at the time of blooming and the formation of the seeds; fruit-bearing plants, like grapevines, at the corresponding period, for the same purpose, need potassa. This is one of the reasons why a liberal manuring pays better than a scanty one.

A rational system of rotation of crops strives to assist in complying with that first condition of success, by arranging the order of succession in such a way that a crop which needs much plant food in a short period of time, follows upon a crop which consumed comparatively little, but left much vegetable matter in the form of leaves, stubble and roots behind; for instance, winter and summer grains after clover and beetroots; for we know, from actual tests, that an

average crop of clover or beetroots, leaves under similar circumstances, the lands in a better condition, as far as the amount of available plant food, as well as the general physical condition of the soil, are concerned, than that of wheat or oats.

A well-devised system of rotation strives to turn the inherent soil resources, as well as the store of atmospheric plant food, to the best account. A skillful management in this direction has, no doubt, a very important bearing on the temporary financial results of the operation; yet it cannot prevent a gradual decline and ultimate failure, as long as local conditions of the soil and the special requirements of local markets exert a controlling influence on a proper selection of crops for rotation; and as long as more or less of the products of the lands are sold from the farm, without restoring in some suitable form the soil constituents abstracted by the articles sold off. For deep-rooting plants enrich merely the surface soil at the expense of the subsoil. Whenever that class of plants fails to find sufficient available amount of mineral plant food in the lower strata of the soil, we may rest assured the end of a remunerative production of crops is at hand. The intrinsic value of that class of plants in field and garden management rests not solely on the fact of preparing an extended area of soil for the immediate support of more shallow-rooting plants, but more emphatically on their decidedly beneficial influence on the physical condition of the entire body of agricultural soil. This influence, as we have seen, is partly due to their individual characteristics, as far as the construction of roots and leaves are concerned; partly, to the mode of cultivation they necessitate, as deep ploughing, and otherwise thorough mechanical treatment of the soil, by repeated ploughing, the liberal use of the cultivator and the hoe.

The character of the industry carried on upon the farm decides the question in regard to the quantity and quality of the fertilizer which ought to be applied to the lands under cultivation. The intimate relation which exists in most farm managements between the cultivation of the soil and the keeping of live stock for farm labor and for the supply of food, imparts to barnyard manure a first importance for our consideration in this connection.

The name barnyard manure has rather a collective than a special meaning. Its composition depends on the character of the food consumed, the age, kind and function of the animals which contribute towards it, the nature of the material which serves for the absorption of the animal excretions, and the care bestowed upon its preparation and keeping.

Its agricultural or crop-producing value depends on its composition and on its general physical condition; its commercial value on the character of the fodder, etc., which served for its production, and on the local supply and demand.

In a well-regulated system of stock feeding it becomes the cheapest source of plant food. To adopt, therefore, a rational system of stock-feeding is the first step towards securing a cheap and efficient source of home-made manure.

It is, for the same reason, but too true an assertion to be seriously questioned, that the information how to feed rationally, and thus economically, *i. e.*, to get from the fodder consumed the best returns in regard to farm labor, increase of live weight and the dairy, as circumstances may prescribe, is not less desirable for a farmer, and only secondary in importance to him, in that respect, than the knowledge how to raise his crops in an economical way.

Amount of Nitrogen, Potash and Phosphoric Acid, contained in the following Fodder Articles, (per ton.) (Analyses by A. WOLFF.)

CROP.	NITROGEN.	POTASH.	PHOSPHORIC ACID.	VALUATION PER 2000 LBS.
	Lbs.	Lbs.	Lbs.	
Meadow hay, ...	31.0	32.0	8.6	$8 02
Clover hay, ...	39.4	37.2	11 2	9 94
Potatoes, (tubers), . .	6.8	11.6	3.2	2 11
Corn, ...	32.0	7.4	11.4	6 88
Beans, ...	81.6	25.8	24.2	17 69
Turnips, ...	3.6	5.8	1.6	1 10
Cotton-seed meal, . . .	73.0	21.8	21.0	15 71
Cotton-seed meal cake, .	120.0	36.0	46.0	26 50
Oat Straw, ...	11.2	32.6	5.6	7 24
Wheat bran, ...	44.8	30.6	53.8	13 13
Linseed cake, ...	94.4	25.0	32.4	20 43
Gluten meal, ...	97.6	1.1	9.0	18 18

In the above valuation, nitrogen is counted at 18 cents per pound; potash, 6 cents; and phosphoric acid, 6 cents.

To take care of every kind of vegetable refuse matter obtained, and to return it, with the careful exclusion of the seeds of weeds, to the soil which produced it, lessens the outlay for plant food, and benefits the continuation of the adopted industry most efficiently.

Wherever the farmer sells a portion of his produce from the farm, without restoring the essential soil constituents they contained, either by buying fodder articles for his live stock, or manurial substances which replace them, he cannot prevent his barnyard manure from changing gradually from a complete manure into a special manure for his industry; for it does not return all the essential articles of plant food needed to reproduce his crops. A change in the composition of the manure is equal to a change in the composition of the soil, in particular of that portion of it which counts in the feeding of the crops.

A liberal supply of pastures and meadow tends only to defer the recognition of these changes by transferring their own resources of fertility to those of the cultivated lands. The history of agriculture in every country teaches the same lessons in this respect.

To count, in case of an intensive farm management, to any great extent, on an efficient supply of mineral plant food, as far as the periodical wants of the plants are concerned, by means of the disintegration of the soil, has proved one of the most uncertain factors for farm calculation; and the same may be said, although with less emphasis, regarding the periodical supply of atmospheric plant food.

The recognition of these and similar circumstances led to the introduction of trade in commercial manurial substances to meet the wants made known by careful observation in the laboratory and the field.

The rapid and extensive introduction of the commercial fertilizers into the farm practice of to-day is the most striking practical acknowledgment, although quite frequently unconsciously given, on the part of the practical farmer, regarding his belief in the usefulness of scientific modes of inquiry in his field of occupation.

The concentrated commercial manurial substances furnish a convenient and efficient means of correcting the composition of our home-made manures, and to make them complete manures for the crops under cultivation.

Their special fitness for this purpose has fairly revolutionized agricultural industry. The farmer of the present finds himself more at liberty to choose his crops with reference to a remunerative market. The great value of chemical and commercial fertilizers, as *supplements* to barnyard manures and other home resources of manurial substances, is to-day universally conceded. They deserve, also, as *substitutes* in various exceptional conditions, a recommendation.

As the former has to deal more or less with all kinds of soil, in varying states of productiveness, he finds himself at times surrounded by serious difficulties to bring his lands into a desirable state of fertility for some paying crop, when depending on inherent soil resources of plant food and a slowly disintegrating barnyard manure. A judicious selection of some special commercial fertilizer can supply, quite frequently, the deficiency, and thereby render a certain succession of crops remunerative, which otherwise would offer no prospect of an economical success.

With these facts before us, we have to acknowledge that our difficulties in arranging an advantageous system of rotation are much lessened when compared with previous periods. We have a better chance to supplement economically our home resources of plant food in such quantity and quality as may be needed for the production of any of our farm or garden crops.

The main point which remains for us to keep in view to-day, in the arrangement of an economical system of rotation, is to secure a desirable advantageous physical condition of the soil for each crop to be cultivated.

Some crops, as potatoes, corn, and some grain crops, if well manured, can more frequently be raised upon the same lands without a serious falling off than others; as, for instance, clover and other deep-rooting leguminous plants. Winter grains prosper best on a somewhat

more compact soil. Clover, root-crops in general and hoed crops, require a well-pulverized soil to do their best. A suitable mechanical condition of the soil is evidently, in these and similar cases, of a paramount importance to a liberal manuring.

Taking this view of the subject under discussion, I conclude with a few general suggestions concerning a system of rotation ; —

I. Crops of the same character ought not to be raised in close succession upon the same lands, — not grain crop after grain crop, or root crop after root crops.

2. Crops which consume large proportions of one or two kinds of mineral constituents in particular ought to be succeeded by those which require but a small quantity of them, — hoed crops after grain crops, or phosphoric acid consuming crops after largely potassa-containing plants.

3. Shallow-rooting plants should follow deep-rooting and foliaceous ones, to economize the vegetable refuse mass left behind by the latter.

4. Some kind of hoed crop should be in the course adopted at least every four years, to assist in the destruction of obnoxious weeds and insects, as well as of parasitic growth of every description.

5. The selection of crops should be made, in a mixed farm management in particular, with reference to an ample supply of fodder crops, to enable the production of a liberal amount of home-made manure for the home industry.

6. Each crop in the adopted course should be placed in such a position as to have the full benefit of a good preparation of the soil, and a proper time for seeding.

7. Crops should also be placed in such a position to each other as to enable an advantageous distribution of the work required during the season, with reference to the resources of labor at disposal.

8. The manure, in particular the barnyard manure, should be liberally given to the hoed crops, and all those crops which necessitate a thorough mechanical preparation of the soil for their successful cul-

tivation, to be thoroughly incorporated into the soil, and facilitate the destruction of the growth of foul seeds.

9. The entire system of cultivation and application of manure of every description should be devised with a view to benefit all parts of the producing area of the farm.

10. The industry adopted should strive to secure from the lands under cultivation the highest pecuniary returns with a fixed determination to improve rather than to impair the productiveness of the lands engaged for its operation.

After the reading of Prof. Goessmann's paper the chairman called for questions or discussion.

MR. SHEDD. I should like to ask, Prof. Goessmann, your opinion in regard to one point. You have given great prominence to the value of commercial fertilizers supplementing barnyard manure. I would like to have your statement on the point whether barnyard manure is particularly rich in nitrogenous matter. Whether there is more nitrogen ordinarily in barnyard manure than in what would be called the complete manure in commercial fertilizers, and, therefore, whether you would increase your proportion in supplementing of the phosphoric acid, giving it a greater proportion for supplementing the barnyard manure.

PROF. GOESSMANN. The nitrogen amounts to about one-half per cent. usually, but still the amount of nitrogen depends a good deal first, upon the kind of fodder which has been consumed, and secondly on the way in which it has been preserved.

MR. SHEDD. Then I understand that in supplementing the barnyard manure you would give what is known as complete manure. I think I have observed in these analyses of barnyard manure, so far as I have noticed them, the proportion given of nitrogenous matter in the barnyard manure is greater than the proportion of nitrogenous matter in the complete fertilizer.

PROF. GOESSMANN. The complete fertilizers—there is really no

basis or standard for it, the price and the cost of nitrogen controls as much as anything else the manufacture.

Mr. Shedd. Then there was another question upon this matter which I supposed was of practical value to farmers. I suppose there is, perhaps, some addition of nitrogen to the soil from the atmosphere. There has been a good deal of discussion, I know, as to whether this can occur or not, but in some way crops seem to obtain nitrogen from the atmosphere. On the other hand there is, I believe, a good deal of loss by drainage of the nitrogen and not much of potash and phosphoric acid. Drainage water running away from land shows a large amount of nitrogen and not much of the other mineral matter.

Prof. Goessmann. That is true.

Mr. Shedd. So that I thought it was a matter of considerable practical value.

Prof. Goessmann. I should rather, perhaps, regulate it by changing the crops.

Mr. Shedd. I wish to get at this which I now understand to be your view as a general rule. Speaking broadly, you would supplement the barnyard manure with the complete commercial fertilizer.

Prof. Goessmann. Yes.

Mr. W. H. Hopkins. Do you recommend mixing stable manure with commercial fertilizer, or separate?

Prof. Goessmann. Separate.

Mr. Shedd. I have been in the habit of having added to the barnyard manure kainite, a certain amount to each herd of stock, and also ground bone. That of course was given to the manure after it was hauled on to the fields, and larger proportion of potash and phosphoric acid than would be in the manure otherwise. That, I thought, was a good practice, but I have not given to it, that way, the complete manure.

PROF. GOESSMANN. Kainite contains potash; also salt, to some extent, contains magnesium compounds and some sulphate of lime or gypsum.

MR. SHEDD. And yet it would be valuable to the plants.

PROF. GOESSMANN. Yes. All we need to do is to prevent the liquid barn manure from running off.

MR. KENYON. Professor, I would like to ask you one question. What would be the loss, comparatively, of spreading barnyard manure, or horse manure, broadcast? Whether it need to be plowed in immediately, or suppose it laid four or five days.

PROF. GOESSMANN. That depends a good deal on the condition of your barnyard manure. If it is rotten already there is no danger of losing anything. But if it is fresh, simply moistened by urinary secretion, there will be an escape of ammonia. Otherwise there is no loss by spreading it over the ground and plowing it after a few days.

On motion of Mr. Shedd a vote of thanks was offered Prof. Goessmann, after which the meeting adjourned.

SECOND LECTURE.

The second meeting of the course was held on Thursday, Jan. 21, at 2 P. M., Pres. Peckham in the chair.

PRES. PECKHAM. At our next meeting Prof. Stockbridge will address us on the "Constituents of Plant Food." To-day I have the pleasure of introducing to you Mr. Edmund Hersey, a member of the Massachusetts State Board of Agriculture, who has chosen for his subject the "Cultivation of the Potato."

MR. HERSEY'S ADDRESS.

Mr. Chairman, Ladies and Gentlemen: I appear before you on this occasion to speak to you on a subject which undoubtedly you are all familiar with. The potato comes from a plant which extends over a very wide extent of country. It will produce crops on a variety of soils if we are satisfied with an ordinary crop. At first thought it would seem hardly worth while to spend an afternoon in talking on a subject which we are so familiar with, and yet if we are to get a large crop, if we are to grow it in the highest state and do it to the best advantage, we find that it is quite a difficult thing to do; quite as much so as any crop which we grow. If we take half an acre of land and prepare it in the best way we know how and one day plant half of it, and then a few days after plant the other half, taking the seed from the same barrel, planting in the same way that we planted the others and cultivate them the same, yet when we come to gather them, when we come to make the harvest, we find that there is a great difference, oftentimes, between the two plantings; sometimes almost one half.

Showing that there are some causes which affect the potato, perhaps, more than other crop. Now I have made it my business during the past thirty-five years to watch the growth of the potato, and yet I am free to confess that if I had stood before you five years ago, I should have thought that I knew a great deal more about the potato than I do now. I am obliged to stand before you here to-day and tell you that after all I know but very little about it. The more you investigate the more you find you don't know—and that is not confined entirely to the potato.

There is a reason why the potato is more fickle than many other crops. The reason which we are very likely to overlook, we do not think of it enough. In planting the potato we do not plant the seed, we do not plant the true seed, we simply plant the tuber. Now there is a vast difference between planting a seed and planting a tuber, and here is where we make a great many mistakes, by not remembering this; and therefore I desire to impress upon your minds at the outset this difference between the seed and the tuber. The seed comes from two incomplete germs of life. As a rule they come from different plants, but not always. But even though they come from the same plant the product from the new seed is different from that from which it was derived. For example, if you plant an Isabella grape seed you do not get from the vine which comes from that seed an Isabella grape, though it may even stand away by itself where it shall not be fertilized from any other vine. This is hard at first to account for. We would suppose, now, that they would be Isabella grapes, but they go back several generations, perhaps, to a grape which was altogether inferior to the Isabella grape. It is very likely to be so you do not get the same results, and so with all seeds. Well, now, the tuber is that which comes from a single life; it is not a new creation as from a seed, but is really an extension as it were, of an old life. If you plant a potato of any particular variety—suppose you plant a Rose potato—you will get the form, color and the qualities of the Rose potato. So you see there is a difference. If you take two seeds from the same plant, each seed has one germ to it, one life germ, and it also has its

stored up power for forcing the new plant, the two seeds just about alike. But if you take a tuber that has several germs of life, several eyes, there are hardly any two of a size. Consequently as they start off in life they are not equal, one will have a great deal more life to force it than the other. Then, again, man steps in and makes even a greater difference. He will take, perhaps, a large potato and cut out all the eyes but one, and he will plant that large potato with one eye. Then by the side of it he will plant one of the eyes he has cut out. So you see one of them will have the whole potato back of it to force the young plant while the other has nothing. Here is a vast difference, and this is a matter that we should keep in mind when we begin to talk about the growth of the potato. There have been a great many theories in regard to potatoes; in regard to the results of planting different kinds of potatoes, different sizes, and in different methods. I remember of listening to a man who was a member of our board, not many years ago, who said that if you plant two varieties of potatoes in one hill they would mix; that you could pick out the different shapes of potatoes and produce almost any shape you please. If you wanted long potatoes, why, pick out the long ones, and you would get very long potatoes. If you wanted round ones, pick out the round ones and you would finally get round potatoes. It has been the almost universal opinion of farmers that if you planted small potatoes one year you would get very good results, but if you continue to plant them they will run out. That has been the idea. Then there has been another theory, and that is that there is a great difference between the two ends of the potato. If you planted the stem end of the potato it would improve it, that is, the large end; while, if you planted the seed end of the potato it would deteriorate and finally run out.

Among the different experiments which I have tried, this is one—(referring to the chart)—the small and the large potato, and the trial has been made very carefully, commencing six years ago. I selected potatoes not over an inch in diameter for the small ones, and for the large ones I selected potatoes that would weigh from three-quarters of a pound to a pound. The large potatoes were weighed and then small

potatoes enough were weighed to make an equal weight. Then the large potatoes were cut in just as many pieces as there were small potatoes. This was done that they might both be equal in weight of seed, keeping in mind the fact that this stored up vitality in the potato had the power to start off the young plant somewhat, especially in common soil—and my trial was made in common soil without heavy manuring. I did this simply because I felt that if we tried experiments we wanted to try them under conditions that they would generally be planted under. I supposed that would be the general conditions, so I took ordinary soil. The result of these experiments is on the chart before you. I have caused them to be hung here because if I should attempt to read them you would not be able to carry them in your mind as well as you could if they were before you. Commencing with the year 1880, this section here (No. 1), is from the small seed. The potatoes when they were dug were sorted, the large from the small; the good potatoes were weighed by themselves and weighed 30¼ lbs. The small potatoes not fit to eat weighed 8¼ lbs., making a total of 38½ lbs. Now here is the large cut seed, just the same number of hills, and in planting them they were not planted in different rows but they were planted in alternate hills; one hill of small seed and the next of large cut seed, and so on through. The large seed made 24 lbs. of large potatoes and 10 lbs. of small; 34 lbs. in all.

Now I will not weary you by running all through this, but will simply give you the result — the result of six years — with the understanding that these were carried down year after year, the same seed. The seed last year — the small seed — came from the small seed planted the first year. They were all boxed each year and kept by themselves, so that the small potatoes planted this year descended from the small potatoes planted the first year. The total for six years of large potatoes from the small seed was 173¾ lbs., while the amount coming from the large seed was 161½ lbs. good potatoes, but you see of small potatoes from the small seed there is but 51 lbs., while from the large seed there is 60¼ lbs.; 9 lbs. less of small potatoes from small seed than from large seed. The result is decidedly in favor of small potatoes.

Now, then, we must be careful in drawing conclusions. Here is the result of six years, but do not understand me as making the assertion here that small potatoes are better to plant than large ones, notwithstanding that it appears upon the chart that here was a gain. There is something which we must consider besides — you must remember that this was a trial not so much to show whether small potatoes were better than large, as it was to establish the fact whether or not there was power in the small potatoes to transmit itself to another crop and continue it year after year without running down. That you might be able to see for yourselves just how the potatoes grew, when the potatoes were dug I had them kept in hills by themselves and photographed, so you could see just how they looked after the end of the six years, and I propose to pass this around, so you will be able, each one of you, to look at them. But I want you to look at them understandingly. I want you to understand just how they are as you look at them. No. 1, as you see marked here, is the small seed, while No. 2 is the large seed. They are arranged just the same on this photograph as they grew, six hills in the row, commencing with No. 1 small, No. 2 large, No. 1 small, No. 2 large, No. 1 small, No. 2 large. You will see by close examination that the quality of potatoes on the No. 1 is better than on the No. 2.

Now, as I said before, don't understand me as setting forth the idea that small potatoes are better than large ones, because the trial is not made for that purpose. If it had been made for that purpose they would have been treated alike, but you see the difference. The small potatoes were planted whole — the large potatoes were cut in sizes the same as the small potatoes. Now there is a vast difference between a cut potato and a whole potato, and I believe that this trial shows — at least to my satisfaction it shows — that when you cut a potato and let its interior open to the air — to the action of the air and the soil, you are weakening its vitality. The whole potatoes, not being cut, had the full vitality of the potato to force the young plants, while the cut potato having its interior exposed to both the soil and the air, was weakened, so that it did not force the young plant with the power with

which the small whole potato does. Now we could see while they were growing the whole potatoes started off vigorous — started off ahead of the others — the cut potatoes kept behind all the time, and when the crop was two-thirds or three-fourths grown there was a difference between the hills of the small and the large potatoes that could be seen at a great distance, and it was my intention to have had them photographed, that they might be shown, but at that time I found it impossible to get a photographer to come just when I wanted him, and so the matter was abandoned. I regret it very much, because it would have shown to you at once that the whole potatoes were a great deal the best on account of the earliness of them. Now it was carried all through the whole season about a week or ten days earlier than the cut potatoes, and I believe wholly on account of the fact that the potato was cut, and by cutting it I had weakened its power to force the young plant. Now I do not suppose that this ever would be seen if the land was very rich — it would not show as much, and so we must all the time keep the conditions before us. There are so many conditions to be considered in raising the potato, that we need to have our eyes open all the time, if we are going to work to the best advantage.

The next experiment which I tried was with the two ends of the potato, the seed end and the stem end, and the trial was made on the same plan that the former ones were made, but these, of course, were both cut. Now the result here was opposite from what I had been taught. I had been taught that the stem end was the best, but I found that the seed end is a great deal the best — 151½ lbs. in the five years, good potatoes from the seed end, where there were only 119¾ lbs. from the other end. There is not the difference in the small potatoes. The seed end was 34¼ lbs., while the stem end was 33 lbs. The difference was almost entirely with the large eating potatoes. I have also had these photographed, but I would say that last year—these photographs are just as they were last year—there was not the difference between the two ends that there had been in years before as you will see from the chart. Here is 27½ to 27¾, rather the other way, but

these results, these photographs show No. 3, the seed end, No. 4 the stem end.

Mr. Smith. May I ask you your explanation of 1882—28 against 38?

Mr. Hersey. Well, I am glad you spoke of that. One year is really no trial of anything; there is so much difference in the seasons. Let me go back to one year — though it does'nt show up there as I should suppose it would — and yet the principle is there. There is a great difference in years about whether you have your crop early or late; that you all know. Some years if you get your crop early enough you will get a large crop; while of that which is planted a little later you will get none. Or it may be the other way — the early crop will not do as well as the late. Now it is the fact that the seed end of the potato starts off first, the same as the small potatoes, just about the same — although last year I examined clear through the season, and I found that the stem end, after all, ripened just about as early as the seed end. Whether they always do or not, I cannot say, because my examinations, as in this year, have always stopped when they had come to their full growth, about a week or ten days earlier than the stem end Therefore there may be certain states of the weather — a drouth comes at a certain time and takes your potatoes just in a condition when it injures them the most, while others that might have been a little later will not be injured quite as much. This was the trouble with those that year, they had got along just enough for the dry week to affect them, while others had not got up to that point, and before they got to that point we had rain. So it makes a difference frequently, in a single season. Therefore, I hold that any experiments in agriculture which we are to make, should be carried along at least ten years. I don't suppose I have got to the end of my rope in experiments. I propose to carry them ten years if I live, and it was not my intention to have made it public till that time; but at the earnest solicitation of the secretary of our board, I have brought this matter out this year. He said he thought six years was enough; but I consider we need to go on sometime longer. I say, further, that we need to have

more than one to try experiments. I have been trying to urge others to take hold of it, and I hope there will be some here who will be willing to take hold of this matter, and see whether their results are like mine or not. I have no doubt under different conditions the result would be different. I have no doubt if you were to take a piece of land and make it very rich you would find a great difference in the results. We know very well that while one man will experiment, and find from his experiments that it is best to seed heavy, another one will try just the same and come to the conclusion he had better seed light. Why this difference? The difference is in the surrounding conditions. The man whose land is very rich, whose land is full of plant food, that man will find it is not necessary to plant the large pieces of potato. If his land is so rich that the little rootlet can get all it wants from the soil, it does not need to have the potato to live on. But if on the other hand, his land is not rich, only ordinary soil, and is not filled with plant food, the little rootlet finds nothing to live on; and so if it does not have the potato itself to fall back on, which is full of plant food, it lingers along, has to wait till the manure which has been applied has been changed to plant food; then it struggles along and he gets a small crop. But if he plants a large piece of potato, when the little rootlet finds that there is nothing in the soil to get, it lives on that potato, and by the time that is consumed perhaps then the soil may be filled with plant food enough so that it will keep on and make a vigorous growth and finally produce a good crop.

So you see the difference between the two individuals; while they are both right as regards their own land, they are both wrong providing you reverse the thing. So you see how important it is that every man who grows potatoes should grow them intelligently. He must understand the condition of his own land; he must understand just what is needed in his surroundings. It would be folly for me to stand here before you, to-day, and undertake to teach one of you how you had better plant your potatoes, how you had better cultivate them, because no two farms are alike and I might give the wrong direction. For instance, if your land is wet, how foolish it would be for me to say

to you, "You must hill up your potatoes." I can only lay down this general principle. If you have wet land you must begin to hill your potatoes when you cover them. If you have dry land you must plant them deep enough so that the hill will be underground. I can say that and then you must judge for yourself what the condition of your land is.

I suppose I had better let them ask me questions, or shall I go on? Hadn't I better let them lead me? I came here simply to tell you what little I know, and that isn't much. I find that I don't know very much about these things, but when I go before an audience I like to talk in the direction they care most about, and if there is anything which I say that I don't make perfectly clear I would like to have you question me. I think it is a better way than it is to go back to the old style of having a man stand on a platform and tell you just what he has a mind to and give you no chance to fire back, and the speaker goes off after that without giving you any chance at all to question him; and the audience go off saying, "I would like to have fired into that fellow." I want to give you a chance to say just what you please, and ask questions.

MR. PECKHAM. Is there any gentleman here who has a question to ask?

MR. HERSEY. The subject is not exhausted.

MR. WINSOR. Did you follow out the same system in your experiments three and four that you did in one and two; that is, plant the same seed stem end?

MR. HERSEY. Yes.

MR. WINSOR. How did you cut the seed end? You must of course have had more than one eye.

MR. HERSEY. No, I didn't. Two eyes. I planted in this way in order to make the thing equal. Two eyes to a piece and two pieces to a hill. They were planted in hills 3½ feet apart, in order to have a fair test. I commenced more than six years ago in this small potato business. My first experiment was to plant the

potatoes just as they were with all the eyes and the pieces just as they chanced to be. Well, the result was I got a good many more potatoes from the small ones than I did from the cut ones, and when I began to talk about that they say, "That isn't fair; you have got a great many more sprouts from your small potatoes than you did from your cut potatoes, and that isn't the way." So I reduced them in order to have a fair test as to the power of the small potatoes.

QUESTION. Did you ever plant large potatoes whole, and what was the result?

MR. HERSEY. I shall not stand here five years from this time and say that I have not; but I have not tried it. I believe myself that the large potato will produce just as well as the small. I am going to tell you what I believe, and now I will try and prove it. This is not a fair test as to whether the small potato is better than the large one, because in cutting the potato it is not an equal thing I know. The way I shall try it will be to cut the small potatoes as well as the large ones. That is the only fair way I know of. I will cut the small and the large ones just the same, and it will be a fair test. And if it should be my fortune to go before the public a few years hence, I shall be able to say what the result is of both trials. Now I will tell you of more experiments, that you may be interested in. I tried one experiment to ascertain whether the sprouting of potatoes weakened their power. So I let the sprouts get five or six inches on some of them, and took them very carefully and set them out so as not to injure the sprout at all; and when set out they came up two or three inches above the ground. By the side of them I planted potatoes that the sprouts were all taken off of, and the fact is I was somewhat astonished at the result. I am going to try that again. The result was that the potatoes that had the sprouts left on, carefully planted potatoes, yielded more than twice as much as those that had the sprouts rubbed off. I don't know whether that will always

be the case or not, but it has been one year. Well, then, I tried another experiment, some years ago in the days of the Jackson white potato. I was then planting potatoes and getting, I thought, pretty good crops. I was very careful to keep my own seed, because I thought I was doing better than my neighbors, who sent to Nova Scotia for their seed. And they tried to convince me that my potatoes were not as good as the Nova Scotia potatoes, and I tried to convince them that they were. We didn't either of us make any progress. Then I thought the thing should be carefully tested, so I bought some Nova Scotia seed, planted it; every other hill with the Nova Scotia and every other hill with mine. And you may guess how I felt when I dug them and found I got 9 bushels from the Nova Scotia, while I got only 5 from mine. The next year I tried the same experiment and kept my potatoes by themselves, and the result was 9 bushels of Nova Scotia's to 6 of mine. I thought I was doing pretty well before, getting a pretty good crop. Then the Jackson White went out of use; it was difficult to get the seed, and the matter was dropped. I have been trying for two or three years to get some one in Nova Scotia who will take some of mine and plant them there, and then exchange. I want to have that thing fairly tested. I think it is important; I can't help being of the opinion now that the seed raised in the higher northern latitude is better than ours, and I think it is better simply because it is stronger; it has more vitality to it; it is stronger, healthier. That is about all we can do with the potato is to get a healthy one; we can't improve it, we can't change the form of it, as you can see by looking at those potatoes there. Six years I have been selecting round potatoes—perfectly round, as near as I could get—and you see the result. They are just as long as those that I planted that were long. But when I come to look at these, side by side, I find I have not made one single step of progress in changing their form. But yet again, you must be

very particular in your selection—and you can get a potato that is better to plant and stronger—and I think we do not pay half attention enough to it. And if I aim to impress upon you one thing more than another, it is the importance of keeping your seed potatoes where they will keep well. You do not want to keep them where they will sprout very much, but you want to keep them in a cool place, where they will keep hard and not be all wilted when you take them out to plant, and where the eyes will not be so long as to be injured in handling. Now I believe we ought to select our potatoes for seed in the autumn, just as much as we select any other seed in the autumn. I believe it is of more consequence that we should select them than that we should select our corn; and yet how few select their seed potatoes in the fall! How many of us take just what happens to be left, and plant them. They may be soft, they may be sprouted, or possibly they may be in good condition. Then there is another thing that I would impress upon your minds, and that is the importance of covering them with something; I believe that the reason why cut potatoes that are rolled in plaster produce better is because of the fact that they are in a measure shut out from the air. It is not the fertililizer that comes from that material. But I believe that if we are to plant good potatoes, we need to cover them with something, so that they shall not be exposed to the air and the soil. Now I have no doubt that that is one of the reasons why there is such a great difference in the few days' difference in planting. It is because the state of the atmosphere and the state of the soil one day may be in that condition that it does not weaken the potato as much as another. There may be a certain state of the soil, it may be wet—but I am not going to say what the state is—but there may be a certain state that affects it very much, and the consequence is a great difference in the amount you will gather.

QUESTION. You recommend selecting our seed in the fall?

MR. HERSEY. Yes.

A LISTENER. I thought you told us we were not selecting seed, but simply tuber.

MR. HERSEY. Let me tell you a story that I think will settle that. Before the Board of Agriculture Capt. Moore got up and said he didn't like it because I had put on "small seed" there. Says he, "I don't like this term seed; it isn't seed, it's tuber. We hadn't ought to say seed, we ought to say *tuber*, *tuber*, that's what they are, tuber." He went on and I sat there and it wasn't two minutes before he began to say seed. So says I, "tuber! tuber!!" And you see I used that term "small seed" because I might get caught as Capt. Moore did.

MR. POTTER. Why would you select your seed in the fall if it is only selecting tuber, and why would you select it in the fall if selecting it doesn't make any difference. Would it be simply to get a good sound potato?

MR. HERSEY. It would be that they might be kept in a proper place; that would be the principal object. I don't know that you could tell a good potato in the autumn much better than you could in the spring, but I think the potato that is to be planted for seed should be kept where it is cool; where it is cooler than where we generally keep our potatoes, and my impression is that they can be kept in leaves quite as well as in any other way. Of course you want to keep them where they will not be chilled, and yet where it is not too warm and dry. It wants a cool moist place, and the reason, I don't know but I might say the only reason, why I would select them in the autumn, would be because I would take more care to keep them as they ought to be kept. I can simply say on this point, I saw a gentleman who is well known to this audience in his gardening. I asked him how he got such noble potatoes, and he says: "When I dig my potatoes I select my seed—the healthiest, best potatoes that I get, with large prominent eyes, the same as you would select your seed corn; then I take

particular care of them; in the Spring I take off the seed end and plant them." I never saw better potatoes than he raises, and he selected them when they lay on the ground.

MR. WINSOR. I would like to inquire which he planted the seed end or the stem end?

MR. HERSEY. On the seed end. Most all potatoes have right on the small end a little cluster of small eyes, and it is the opinion of a great many that if you cut that off the stronger eyes below will grow; where the others are gone they make a better potato. I of course rather question whether very many of those little eyes on the very end grow at all.

A LISTENER. If you should plant that potato you would not get more than five or six plants from it.

QUESTION. Did you ever plant a potato where you had already taken out every eye?

MR. HERSEY. I never have.

—— ——. I have, and it takes three weeks longer to come. They come but they are very weak and good for nothing.

QUESTION. What has been your largest yield per acre, and what variety?

MR. HERSEY. I raised once 554 bushels—the old fashioned Long Red. It was a trial of strength between myself and my father.

A LISTENER. A great while ago?

MR. HERSEY. Yes, thirty years ago, very near. My father was an experimental farmer and when I came on the stage we had some trials of strength as a consequence.

MR. POTTER. Not physical. (Laughter.)

QUESTION. I would like to inquire what the difference in the result of the crop would be in planting two eyes in a piece and two pieces in a hill. What the difference would be in the result of the crop?

MR. HERSEY. Well, that would depend entirely upon the condi-

tion of the soil, as I have already intimated to you that the amount of seed which you are to plant depends very much on the condition of your soil. Well, if I look at it in the right light I would get the same amount of seed from one piece that I would from two pieces.

A LISTENER. Mr. Hersey I don't think I fully understand you. I may have misunderstood you that you planted two eyes on a piece and two pieces in a hill.

MR. HERSEY. Yes, four eyes to a hill.

A LISTENER. What I want to come at is, if I plant one piece with four eyes, wouldn't I get the same result?

MR. HERSEY. That would depend upon the condition of the soil and the size. If it was uncultured you wouldn't get as much, but if it was highly cultivated I don't think it would make much difference. I don't think it would. That would be, I imagine, whether there was enough food in the soil to support the plant. If you scatter the seed of course poorer soil will sustain the plant, but if you have it all in one place if there is enough behind it will grow.

A LISTENER. I planted potatoes last year, two eyes to a piece—drilled them. Did you plant them in hills?

MR. HERSEY. Yes, I plant mine in hills, for the experiments, because I can do better justice to each one. I can plant them and take care of them so, and they will mature better than they would if they were planted in rows.

A LISTENER. What distance are your hills apart?

MR. HERSEY. About 3½ feet; not quite. I plant five rows to a rod.

A LISTENER. About equal distance each way?

MR. HERSEY. About equal distance each way.

QUESTION. Do you consider you get as good results in planting as far apart as that? It could be closer in richer soil.

Mr. Hersey. Forty inches apart—your tops would cover the ground. That is as thick as you would want to go through to put on Paris Green. If I was going to make a trial to see how many I could grow to an acre I am inclined to think I would raise them in rows, but when I got those 554 bushels to the acre I planted hills about forty inches apart. I recollect digging a bushel from seven hills.

Mr. Potter. Have you ever seen a potato that would yield like the old Long Red; ever seen any since?

Mr. Hersey. I had at that time one that yielded better; I don't remember the name of it, but it was not good for anything; it was a coarse thing.

A Listener. The Long Red was coarse.

Mr. Hersey. The last of our raising the Long Red was better.

—— ———. Yes, and in quantity.

Mr. Hersey. The potato changes gradually; not being the true seed, it gradually advances or it retrogrades, one of the two. There are some varieties that grow better, while there are other varieties that grow poorer from the seed. The old Long Red — there were a great many years when it was hardly fit to eat. The old Chenango was good in its early days, but it depreciated. The old yellow potato depreciated. In all those things we want to consider the fact that it is really carrying along, as it were, an old life. It is not a renewal of one.

Mr. Potter. Like grafting a tree?

Mr. Hersey. Yes, it is a similar thing. It eventually runs out, and in my opinion the potato becomes, in consequence of carrying it along, weakened in its vitality and its susceptibility to take diseases increased, and I believe that the potato disease was brought about partly in consequence of the fact that we had not gone back to the true seed, as we ought to have done. When we did go back to the seed it was too late.

Mr. A. S. Hawes. What variety are you using now for market?

Mr. Hersey. Well, I am not a man who raises potatoes very much for market, sometimes half an acre or so. I have been raising the early Plymouth County.

Mr. T. G. Potter. Is that the potato you have there?

Mr. Hersey. No, sir. It is one I found in the office here. I meant to have brought some, but I came away and did not think of it.

Mr. Angell. My father raised a potato in Saratoga county called the Rusty Coat. He kept those potatoes some thirty years, and he said he could not get a potato equal to them. He kept them separate some thirty years. It was very peculiar.

Mr. Hersey. I suppose the potato which to-day stands the highest is the "Beauty of Hebron."

Mr. Potter. What do you think of potato scabs? It is very fashionable to talk about that now.

Mr. Hersey. I think there is not one of you here but what knows just as much about it as I do.

Mr. Potter. And as much as anybody else?

Mr. Hersey. I don't think we can tell very much about it. If I had come here two years ago I might have made a little spread; I thought I knew something about it, but I have found I don't know anything about it. It is one of those things which I think we do not understand at present.

Mr. T. G. Potter. I saw last week in a Massachusetts agricultural paper, an article headed, "The Pototo Scab Conundrum." Perhaps you saw it?

Mr. Hersey. No.

Mr. T. G. Potter. A certain man went on to relate his experience He planted on dry land running down into peat land, and on the hill his potatoes were very scabby, but when he got down to heavier land they were very good. Three other articles in the

same paper stated that if you want scabby potatoes, plant them on moist land. The editor headed it "The Potato Scab Conundrum," and that is about all there is to it.

MR. HERSEY. I had supposed that the scab was a disease which could be carried from one year to another, and I thought that I had demonstrated that fact two years ago. I tried it for two years and I found that the potatoes I planted that were free from scab were not scabby, while the scabby seed produced scabby potatoes. But last year it was reversed. Last year I planted half a peck of some potatoes which I bought, a choice kind, and to my mortification, when they came, there wasn't one but what was all scabby, as bad as I ever saw. I told my man I guessed we had better plant them, but I said to him, "Plant them in a rather dry soil," and I says, "fertilize them with ground bone and muriate of potash." Well, I thought he knew, in fact he did; he was a very intelligent man, he was careless, I suppose; but instead of putting in muriate of potash he put in nitrate of soda, and he put in a pretty good dose of it, and put it in the thickest at first; at the last end he didn't put in as much. It was a little too much for the first ones, but the other end was splendid. When I came to dig them they were all good, and just as handsome as you ever saw, free from scab. Was it the nitrate of soda, or what was it? Perhaps next year I should have all scabby potatoes if I did it.

MR. T. G. POTTER. Isn't it a very good plan to get Nova Scotia potatoes and plant them side by side with ours. My opinion is that if you took ours and carried them to Nova Scotia, plant them two or three times, and then bring them back here, and you would have as good a crop as of Nova Scotias.

MR. HERSEY. To get a good crop of potatoes there is one condition, I think, we must have. I don't think we can grow large crops of potatoes, in fact I am doubtful whether we can grow large crops of anything without a thorough preparation of the soil. I

believe that farmers generally fail in the preparation of the soil before the crop is planted. There is a power in the soil to make plants grow that needs that porous condition of the soil, a condition which we cannot very well bring about after we plant. I believe it is necessary that the soil should be thoroughly mixed with the fertilizer. I don't myself believe in placing very much fertilizer in the hill. I know that there are some fertilizers that you can put a very little of in the hill that are very beneficial; they will start off the young plant; but to do as our fathers did, put a fork full of manure into a hill, I don't believe in it. I think it will not bring about that condition of the soil which is necessary for a large crop. If you prepare the soil by fertilizing and mixing the manure with it, you are filling it at the proper season with plant food. Now, as I understand it, the plants do not run after the food, but the food runs after the plants, and is drawn into the plants just the same as the smoke is drawn into the chimney from the fire place. Of course you understand that first the fertilizer must be so decomposed as to be brought into atoms. These atoms are mixed with both air and water, and they circulate in the soil. Now, without the soil being pulverized there are no passage ways where this food can freely circulate, so as to get to the plant. I believe that is what we do when we prepare our soil as it should be; we pulverize it so that it is porous, so that the air may easily pass through it and unite with these atoms of food, and they are carried towards the plants and the plants draw them in. I believe that we can devote our time no better than by thoroughly preparing our soil before we put seed into the ground.

MR. HOPKINS. How deep?

MR. HERSEY. Well, I should say not deep. I don't believe it is necessary. I believe that if you put in coarse manure you might plow it in; that, of course, depends on the condition of your soil how deep you plow it. You don't want to plow your soil down and

turn up the dead earth. You can deepen your soil an inch in a year. But you want to pulverize down, say three inches, not much more than that, to mix your manure, simply because the manure, or whatever fertilizer you apply, to decompose requires both air, moisture and heat. If you are going to get them, you must get them very near the surface. If you should stir your manure in, down several inches you would not get the benefit of it, it would not decompose the first year, not very much of it, but if you have it just low enough below the surface where the moisture is sufficient to carry on this decomposition with the heat, then you are getting the very best conditions.

Mr. Larkin. Would you get it the second year?

Mr. Hersey. Certainly you would if you turned it back again, and that is why some people say, "I plow my manure in, and I always have good results." He does not get it the first year, he gets it the second.

Mr. Larkin. Don't you think the manure meets with changes after it is plowed in in that way?

Mr. Hersey. Of course there is all the time a slight decomposition going on but it doesn't begin to be so rapid as it is up higher where it gets more heat.

Mr. Hawes. Which do you consider better, sod land or old land for potatoes?

Mr. Hersey. I should say on my land I would get better crops the second year, but there are lands where I have thought you would get the best the first year. It depends on the moisture of soil. My soil would be too dry to plant the first year.

Mr. T. G. Potter. Have you ever heard of their growing potatoes in the town of Plymouth, such immense quantities of early potatoes?

Mr. Hersey. Well, I don't know as I have heard anything in particular.

Mr. T. G. Potter. Their soil is a clay soil. I want to tell you what I have seen in this matter. I have seen sea weed which has been there, turned down seven inches and laid there seven years, and been plowed up not quite so whole as when put in. On sandy soil we put it down nine inches or eleven inches, and it would decompose, the circulation gets to it, but there it couldn't; the heat couldn't get to it in that clayey soil. It will on my land, that is sandy ; plow it down five, seven or nine inches, and we don't find anything whole when we plow it up the next year.

Mr. Hersey. I have seen it after it has been plowed in thirty years, and it would be just as whole as when turned under. That is a fact; My father tried a great many experiments with sea weed. I carted one hundred loads one year, simply for experimental purposes, and after about eight years trial he made up his mind it wasn't worth anything, that is, the eel-grass.

Mr. A. S. Hawes. What is the better way of applying Paris Green ?

Mr. Hersey. Well, I apply it with water, because I don't have large quantities, if I had large quantities, large fields, I don't know as I should use water ; if I did I would get one of those things that go on to your back. I don't like to use plaster or lime. I used to use once, air-slacked lime, but I think there is more danger of breathing it if you use it with any dry substance than there is if you use it with water. It seems to me there is no danger in using it with water, but I admit if you have a large field it requires, perhaps, more labor to apply it in water than it would in some dry substance. I think as a rule we use too much Paris Green. It doesn't require but little.

Mr. A. S. Hawes. How often do you apply it ?

Mr. Hersey. Well, I don't apply it more than three times in the course of the season, that is sufficient. I have a watering-pot that is made expressly for the purpose. The holes in the watering-

pot were too large, I painted them over and then took a needle and pricked through the holes so the streams were very fine, and you can go right along as fast as you can walk. I think we are getting rid of the potato bug by using Paris Green. We do not have so many; I find every year they are growing less with me. I had but very few last year.

Mr. T. G. Potter. Don't you think there is a parasite at work on them to a measure?

Mr. Hersey. Well, I don't know but what there is.

Mr. C. W. Smith. You have just suggested that they are growing less with you. Will some of the people here who have had experience, give it? There are quite a number who have told me here that the bugs were very much less this season than heretofore. It may be of some interest to them to know whether this is general or not.

Mr. Larkin. This past season I had two fields of potatoes; one was planted early, and on the early potatoes I had very few bugs, the second crop I set right out again, replanted the 17th of June, and I never had so many potato bugs before as I had on that field of potatoes. We had to Paris Green them three times.

Mr. W. H. Potter. Did you use Paris Green on your first crop?

Mr. Larkin. Yes, and killed all the bugs. We went over them three times, and they hung as long as they kept green, till the frost came.

Mr. Isaac Hazard. Do you think you can put on too much manure for the potatoes to grow well?

Mr. Hersey. I believe you can, but I can't afford to; perhaps some people can. Of course you can put in manure enough to mulch the potatoes so they will not be as good; I think you can do that. I think on very light land you might plow in too much. I don't think you can put too much on top. But I do not think we

need to fear that we shall over-manure our land. The fear is that we shall not give it enough. The fact is this is a rule which may apply not only to the potato crop but to all other crops. I think that the most successful gardener that we have in the vicinity of Boston, applies not less than thirty cords of manure to an acre every year.

MR. ISAAC HAZARD. On potatoes?

MR. HERSEY. He raises garden crops; and a good gardener does not confine himself to one crop, but raises perhaps three crops on the same land each year, which gives ten cords to each crop. He has some sixty acres under cultivation, and he uses pretty much altogether stable manure. My impression is that when we get to using so much manure we should save by it if we used a part commercial fertilizer, provided we know what we are using, and use it intelligently. That is the great trouble in using fertilizer for potatoes, or any other crop — we are very apt to use it blindfolded. We can use farm manure without very great intelligence, but the moment we begin to dip into commercial fertilizer, we need some knowledge of what it is composed of, simply because there is a great difference in fertilizers — while one may be rich in phosphates, another may be poorer in phosphates and rich in potash, and another perhaps may be rich in nitrogen, while another may have no nitrogen. We need to know just what the land wants. And, second, we need to know what the fertilizer is composed of. I think we can supplement our manures to great advantage, but I am of the opinion that a great many fertilizers are used in such a haphazard manner that they never bring back the money they cost.

MR. HOPKINS. Can the ordinary farmer obtain the knowledge as to what his farm needs except by observation and previous crops?

MR. HERSEY. No, I believe not. Prof. Goessmann states that

you cannot analyze the soil so as to tell what it wants, simply because the amount which you analyze is so small in comparison to the whole that there would be no certainty as to what the land would average. Every farmer has got to learn his own farm; he has got to learn the character of his own soil; he has got to learn the needs of the crop which he grows, and whether it is adapted to his particular soil — so that it raises the successful farmer up where he must be intelligent. The time has come when the successful farmer must himself know what his land needs by actual observation and by trial, constant trial, and that is a constant fight. He will undoubtedly, even if he be intelligent, make many mistakes, no doubt of that. I question whether any farmer ever yet arrived at that height where he can go on and tell just what is the very best thing to apply to each field. He can, after all, only guess at it. At a public meeting within six months, following a lecture upon commercial fertilizers, where the rules were laid down so plain that it seemed as though everybody might understand, I got up and said, "I, myself, must confess that although I have been working on a piece of land that was owned by my father, where in boyhood I saw him try experiment after experiment, where I have followed him and tried experiment after experiment, I do not myself now know what is the very best thing I can apply to that soil, I can only guess at it, and I guess wrong sometimes." Now let me tell you, during the last year I had a couple of acres of asparagus, and it was a question with me what I had better put on as a common fertilizer. I didn't want to put on stable manure, I wanted to put on commercial fertilizer. A dealer in fertilizers told me that one of the best things to put on was nitrate of soda, and I said, "Do you think so? I did not suppose so; I rather doubt it." "I know it is," he said, "try it." I like to try all these things, so I got $3 or $4 worth of it, simply as an experiment, and put it on every fourth row, and no man could tell where it was

put. So that was lost. It was gain in one way, though I shall not do it next year.

Mr. Potter. Next year you will see the difference.

Mr. Hersey. No, nitrate of soda, you know, you are supposed to get about all of that the first year, it is a material which is not carried over, not very much of it. I put that down for profit and loss.

Mr. Potter. I think yours was carried under.

Mr. Hersey. I don't know whether it was carried under or went off.

Mr. Hawes. If a farmer finds just what his land wants, can't he carry that too far, just like mixing two colors of paint, and need another color to tone it up with? If his land needed potash wouldn't he soon need something to go with it?

Mr. Hersey. That is one of the things that we must all the time be guarding against. Because the application of potash does a great thing this year, it is no evidence it will do the same thing next year. But when you come to nitrate of soda that is a material which we suppose has to be applied every year; not so with phosphoric acid; land may be deficient in phosphoric acid and we may apply it and find good results from it, but it doesn't follow that it will need to be applied the next year; it may need some other material. I was at one time carrying on a manufacturing business, and made considerable quantities of wood ashes, and my men would apply it in such quantities, they would apply it as free as if it was barn manure, and I could not help myself, and they got so much on the land that it didn't do any good at all. Then I put on to the land phosphoric acid in the shape of ground bone, and the result was very satisfactory for some years, yet the time came when I had to resort to potash again. We have got to be all the time watching. We have got to make up our calculation about how much we are taking off of the different materials from

our land, and then estimate, or guess, what it will be best to apply the next year. There is one thing that you may be safe on, and that is, as a rule, you won't lose by applying too much phosphoric acid or potash. These are two elements which do not fly away in the air. A very little will sink down into the streams below. If you do not get it this year you will get it the next year, or the year after. But when you apply anything in the form of nitrogen you must expect to have that right away, or you will never get it at all. Now there is one thing I may say in regard to barn manure in connection with the potato crop; you may apply barn manure which analyzes worth less than $3 a cord. You may apply that to potatoes and it will be worth $6 a cord. The reason is this: because of its mechanical action upon the soil. I believe the decomposition of barn manure upon the soil decomposes the soil and lets loose plant food which heretofore has been locked up in it. All the plant food originally came from the rocks, and whatever you can put on the land that starts this decomposition is a gain. Therefore I think that in applying barn manure, we must take that into consideration. If we should apply, year after year, nothing but concentrated commercial fertilizer, we could not expect to get very much from the original soil; we should not decompose the soil very much, and so should have to rely entirely upon the fertilizer that we apply. But when we apply barn manure we may depend upon getting a good portion of plant food from the soil itself, and yet leave the soil just as good as it was before, it is not using up the soil, the decomposition of it, because there is enough of it left, and the more we decompose it the better it is.

Mr. Peckham. Before closing I wish to state once more that at our meeting next week we are to be addressed by Prof. Stockbridge on the "Constituents of Plant Food."

Mr. C. W. Smith. I think the audience has been very much pleased with the discussion here this afternoon, and the address of

Mr. Hersey, and as our finances are such that we cannot afford to pay very large prices for this kind of work, we should express our thanks to him. I move a vote of thanks to the speaker for his able address.

(Unanimously adopted.)

MR. SMITH. I have just consulted with a member of the committee, and the idea has been suggested to me that a question box here would be a very good thing to have — where written question may be dropped in, on any subject of agriculture which they wish to discuss. It will help the committee on meetings in getting speakers; also make a subject for discussion for the meetings at any time. At the next meeting I will have something prepared here, if it is nothing more than a hat, in which written questions may be dropped so that they may be put in and discussed at any time—at that meeting or some other.

Adjourned.

THIRD LECTURE.

The third in the series of meetings was held at the usual place Thursday, January 28, at 2 P. M., President Peckham presiding.

Prof. Levi Stockbridge delivered the following address on "Plant Constituents":

Mr. Chairman and gentlemen of the Rhode Island Board of Agriculture and Society for the Encouragement of Domestic Industry:

As has been announced, at the suggestion of your Secretary, I am to talk to you about the composition of plants. But methinks for me to do this is something like carrying coals to Newcastle. Men who have the intelligence and enterprise to support your Board of Agriculture and your society, men who have for a long, long time been engaged in the business of making plants certainly ought to know all about them. I doubt not that you do. You ought to know all about the organs of plants and the functions of those organs as well as of what plants are made and what is the capacity of plants for the various uses for which we grow them upon the farm, or for which we sell them in the market. Now while this is the fact I know very well that there are a great many farmers who do not know this. I find them all over New England, men who if they were questioned in relation to the composition of plants, what plants were or whence they came, would probably make about the same answer that Topsy made when they asked her who made her. She said she didn't know, but she s'posed she growed. I think there are a great many farmers, who if asked the question about the composition or organism of plants would have to

make that answer, "They didn't know, but supposed they grew." Now it is a common sense statement, and I suppose gentlemen of intelligence would agree with me that a farmer whose business, whose life work it is to make plants should, as a matter of course, know what plants are. He ought to know this just as much as a man who is engaged in any other business or pursuit knows all about the product he is making or manufacturing. Why not? The mechanics and engineers who built the Brooklyn bridge knew exactly the tensile strength of every strand of wire that went across the river, they knew exactly how many pounds the wire would support, how many wires it was necessary to put into the cable, and how many cables to support the superstructure of the bridge and all the weight that would be placed upon it.

So at Niagara, so that millions of tons and millions of people are carried across this chasm with safety because the mechanics knew what they were doing in putting every strand of wire across there. In other branches, too, the mechanic knows, who makes steam boilers, the material on which he works so well, that he knows exactly how much pressure that boiler will stand, because he knows the material that goes into it.

And in other departments, men who work in wood, and iron, and stone always know before they begin to make a certain structure what the breaking weight is, what it will sustain. They know the material they use in their work. Now pray tell me why should not the farmer know? It seems to me he should know, that it is only common sense. But if I am to speak upon the subject at all I must speak just as if you did not know anything about it, and if you have no occasion to hear for yourselves do as we do when we go to church sometimes, hear for somebody else, and that way I shall not talk in vain.

It seems to me that every farmer should know first what the organs of plants are and what are the functions and offices which those organs are calculated to perform, because his manner of managing plants will depend very much on his knowledge of this fact. As, for instance, he should know what the office of the root is. Now the root

of a plant has two offices, perhaps more, but I will say two. To anchor the plant to the ground, and keep it in upright position; another office is to gather from the soil the materials that are needed for the sustenance of the plant, and to gather water from the soil to keep the plant turgid. All plants do not have the same root development. The characteristics of the root development differ in various orders of plants, and the farmer ought to know some of these characteristics, because he can adapt his plant better to the soil and circumstances if he does know. Some plants have short, very fibrous rootlets that permeate only through the surface soil. Other plants have very long rootlets which permeate the deepest sub-soil. The clover plant will send its roots down to the depth of seven, eight or ten feet, and sometimes six or eight in the hardest kind of soil. The roots of different plants vary in their power over the particles of soil. One plant has very little, another plant seems to have the power to wring out of the hard granite particles of the soil food, while another plant with its peculiar kind of rootlets would find no food at all. Then another quality of the roots of plants is the great power which some roots have of gathering water and pumping it up and throwing it to the farthest extensions of the plants. There are some plant rootlets which have no such force. It is proved by experiment that a root severed from its tree and attached to an apparatus may throw up and sustain a column of water 120 feet in height, while another has almost imperceptible power in its root to throw and sustain a column of water.

Now then. They have another capacity, it seems to me, that is, they have the power to select from the soil such food as the plant requires. While, of course, the food must all be passed into the plant in the form of a solution, no solid food goes into the plant. The plant seems to have the power to select such particles in solution as the best development of the plant requires. Now, I will speak of another plant organ that every farmer should know about—the leaf. The leaf for the best interest of the plant should be on it because the leaves and roots work together in harmony to accomplish one and the same result. The roots pump water up, they pump more water than is

needed in the textures of the plant for the purpose of forming a plant, and what is not needed is thrown back into the air through the leaves. Leaves may be said to be the respiratory organs of the plant. The plant breathes through its leaves. Then, again, the leaves are great food gatherers; not all, but a very large proportion of the organic food of the plant is gathered from the atmosphere by the leaves. Especially do our fruits depend upon the presence of the leaves. I have heard men say that it was a good plan to take leaves off to let the sun in so that the fruit could ripen, now if you want to destroy your fruit you cannot do it in any way so well as to take off the leaves.

There must be a certain corresponding relation between the root and the leaf, and oftentimes it is a good plan to feed them with those kinds of food which create large leaf extension because they are the feeding organs of the plant and the changes which take place in the leaf are necessary to supply to the plant the essential elements There is one other organ I think it will not be out of place to say a few words upon, and that is the flower of the plant. I do not suppose flowers send out their beautiful fragrance and color just for the sake of beautifying the earth and pleasing our eyes. The flower is a special organ which the plant has for a specific purpose, and within the opening flower are other organs. Every plant goes through its life so far as nature is concerned for the express purpose of perpetuating its species, and the organs of reproduction are within the flower—stamens and pistils. Now while these are not always in the same flower or always in the same plant, they are absolutely essential. In some plants these organs are not properly developed. Unless the stamen and pistil are in proportion the seed will not develop. Every farmer should understand what this means and he can make use of it in always seeing that these parts are developed in their proper proportions. These are practical points of importance why the farmer should understand more of this part of the plant,—the organs of the plant.

Here I come to speak of the composition of the plant. It is true that all plants, every kind of plant on the earth's surface is made up of the same material but not always in the same proportion by any

manner of means. And whatever plant you examine you will find you have got the same materials in one as in the other. The same materials in the corn as in the rye; the same materials in the leaf as in the stem, but in different proportions; and these different proportions are what give the peculiar characteristics or qualities to the plants. Not because they are not all of them, the apple sweet and the apple sour, made precisely alike, but different proportions of the different elements have entered into the plant and given the quality. In pursuing this subject a little further, and because I want to use it before I get done, I am going to try your patience and see how you will stand some pretty dry reading, but I will try to use it in such a way as to make it useful.

Now, plants in their composition are divided into solid and solution, or water. Plants are water and solids, that is the first division in the composition. And for a good reason I will read first this composition in relation to the per cent. of water and the per cent. of solid in many of our common plants. And I take only our well-known plants, although the tables give you the whole list of plants grown on the farm, and more too. My friend who is a great advocate of ensilage will see here something that comes very near to his ensilage. For the sake of showing you what you feed your cattle where you feed green plants, I will state that meadow grass in 1000 lbs. has 800 lbs. of water, nothing but common water. Timothy grass has in 1000 lbs. 700 lbs. of water. Red clover, in 1000 lbs. has 815 lbs. of water. White clover, in 1000 lbs. has 805 lbs. of water. Corn stalks, such as we use when we feed our cattle with corn fodder, has 822 lbs. of water in 1000 lbs. Potatoes, 750 lbs. of water in 1000 lbs. Mangel wurzels has 880 lbs. of water in 1000 lbs. Sugar beets in 1000 lbs., 815 lbs. of water. Carrots, in 1000 lbs., 850 lbs. water. Turnips 920 lbs. water in 1000 lbs. Brewers' grains, which are being introduced to a considerable extent as feed for cows, 766 lbs. water in 1000 lbs.

Now, because I will try to use it by and by, I will give you another item just here. It is said that all the world is made of water. Take young animals, lambs, or calves, or pigs, or anything of that

kind. The live weight of these animals contains in 1000 lbs. 800 lbs. of water, nothing but water. Old animals in 1000 lbs., would have 600 lbs. of water. You take an ordinary man right in the prime of life and squeeze him dry you would have, starting with 150 lbs., 40 or 50 lbs. left; that is all there would be of him.

I give that simply to show what we feed when we feed this corn fodder, and for the next reason because when we undertake to get the analysis of the real nutritive contents of our crop the chemist estimates them dry or air dry. When they say such and such a thing contains so much of this and that and the other, they estimate them dry. Now then I will give you another table of the same materials. I mean dry as you store them in the barn; your hay and grain as dry materials, they still contain a good deal of water, and when the chemist by and by undertakes to tell you how much nutrition you feed in a given article, he tells you what the nutrition is in the article chemically dry, whereas you have it air dry. You remember I am now speaking of the composition of the plants solid, and water. Meadow hay, the same I gave before, 1000 lbs. air dry — as dry as the air will dry it, and a good sun — 143 lbs. of water; Timothy hay the same, 143 lbs. water to 1000 lbs; Red clover in 1000 lbs. contains 160 lbs of water; White clover, 160 lbs.; Corn stalks dried, 150 lbs.; Wheat shorts, one of our new feeds, 131 lbs.; Corn meal, 140 lbs.; Linseed meal, 115 lbs.; Cotton seed meal, the same, 115 lbs. The next division of our plants is organic and inorganic matter. Our plants as you are aware are made up of material gathered from the air and from the soil; that from the air we call the organic matter, that from the soil we call the inorganic, the ash; and yet we give this same substance different names under different circumstances, but it comes down to this: organic matter material from the air, inorganic material from the soil. Material from the soil, inorganic matter, being the ash, you burn any plant or destroy it by slow combustion, decomposition or in any way, and almost all the plant is destroyed; the inorganic mineral matter, or the ash, is but a very small particle compared with that which has disappeared again into the atmosphere, but how much is inorganic, and

how much is mineral, of the air dry plant? That I will give you in this table. I take the same crops because they are the crops we generally use; 1000 lbs. of air dried meadow hay contains 948 lbs. of organic and 51 lbs. of ash or mineral matter, a very great discrepancy between the two. Timothy hay contains 937 lbs. of organic matter, and 62 lbs. ash; Red clover, 933 lbs. organic matter, 66 lbs. ash; White clover has 940 lbs. organic matter, 59 lbs. ash; Corn stalks, 958 lbs. organic matter, 41 lbs. ash; Wheat shorts 946 lbs. organic, 53 lbs. ash; Corn meal 944 lbs., 6 lbs. ash; Linseed meal 949 lbs. organic matter, 50 lbs. ash; Cotton seed 941 lbs. organic matter, 58 lbs. ash; Brewers grains, 988 lbs. or ganic matter, 12 lbs. ash. Now you see the very great difference. After all we find that it is only the smallest possible part of the plant that comes from the soil, almost all of it comes from the air. When I say this I want you to know I understand perfectly well that organic matter may be in certain forms, like the manure from the barnyard and like turf plowed in, and act as a fertilizer in the soil, but it is organic matter just the same, its original home was the air; from the air into the plant, and from that into another generation of plants. Now we have our composition reduced to this, ash and organic matter. It is quite important, you see, that we should know sometimes what the ash is, and what the organic matter is; we have got it into two great classes of matter. What is the ash and what is the organic matter? Now this is a dry table, I don't know as it is worth while for me to read it; but I will read two or three simply, and they will answer perhaps for the whole. Meadow hay — what is it? We have sixty or more, I don't know how many, mineral elements. Chemists are all the time working; new things are being discovered every year, and I don't know how many inorganic elements we have to-day, but all the inorganic elements our plants do not take, they cannot be made to take. The Lord seems to have fixed this a great while ago; he started them in a certain way, he made them in a certain way, and they vary but very little. The grains are made in one way and the roots are made in another way. I mean now the compo-

sition, and while under different circumstances and in different soils, there is a slight variation in the composition, yet they come so near alike that the chemist classifies them, and he tells us the potato is made so and so, and he gives you a table of the weight of the inorganic elements, the weights are so and so. All agree it is the analysis of weight by its average; I will give you a few: Meadow hay — we have it in our barns — a thousand pounds has 13 lbs. potash, 2 lbs. soda, 9 lbs. lime, 3 lbs. magnesia, 4 lbs. phosphoric acid, 2 lbs. sulphuric acid, 14 lbs. silica. Now I will give you one of our grains, we'll take corn meal: 1000 lbs. of corn meal, Indian corn, has 1.7 lbs. potash, .2 lb. of soda, .4 lb. lime, 9 lbs. magnesia, 2.6 lbs. phosphoric acid, and perhaps silica. This is the composition of Indian meal. I think I can give you the grain, for instance, analyzed a little different from the meal, and I will give you the analysis of the ash of Indian corn: 1000 lbs. of Indian corn, then contains 4 lbs. of potash, 2 lbs. of soda, 3 lbs. of lime, 2 lbs. of magnesia, 6 lbs. of phosphoric acid, 2 lbs. sulphuric acid, 2 lbs. silica; that is sufficient; you can find every plant that is grown in the tables; you will see that these elements are found in all plants, and I doubt very much if you would not find it very hard work to force a plant to take any other than the needed elements. If it could not find potash in the soil it would not take magnesia to take the place; it would stop growing, and the test of the fertility of that soil would be measured by the available potash in that soil, however rich it might be with the other elements, only those elements found in the plants, and they must be present in the soil in an available form, or it will not grow, the fertility of the soil should be measured always by the minimum quantity of one of the needed elements. You may have an abundance of everything else, but if one needed element is deficient the plant stops growing when that element is exhausted. I have given the composition of the ash, the inorganic elements of the plant, now I will give you the composition of the organic elements. Every plant has the four organic elements—carbon, oxygen, hydrogen, and nitrogen—every plant has those, no plant is without them, but the organic elements in the plants vary in different species

of plants, the same as the inorganic elements did under varying circumstances. You may have a little more of one thing or another, yet the chemist comes down to the point and says, "The average is so and so," and he has made his table so, and we accept it. The certain composition given in the chemist's table is the rule, not in relation to single plants, but the rule in relation to classes of plants. Every plant has the four organic elements—carbon, oxygen, nitrogen and hydrogen. But in the plant, when we attempt to analyze it, we do not term them carbon, oxygen, hydrogen and nitrogen, always; the chemists gives other names to the organic substances, for instance: the chemist sometimes calls the nitrogen, the albumenoids that are found in the plant, protein; but practically comes down to this — *nitrogenous* — because all these names, protein, albumenoids, etc., all come to be nitrogen. And so we see plants contain all these different forms of nitrogen, and we say it contains so much albumenoid, a certain per cent. Now as to the carbon in the plants, so far as the chemist is concerned, he never finds carbon in the plant as carbon; he finds some compound of carbon. The plant takes in by its leaves carbonic acid in the air. The oxygen is thrown back into the air, the carbon that is retained turns to other forms, first starch, then it forms sugar, then it forms gum. All these things are in the plant and other compounds, so we call them in that form, carbo-hydrates, and it makes your starch, sugar, gum, etc., and they give these organic elements in the plants the names of albumenoids and carbo-hydrates. The oxygen and the hydrogen in the plants are of precious little account with the chemist, because they are always available in abundance. The animal is never in any great need of an artificial supply of oxygen and hydrogen, for by drinking water he can get both, so that but little practical account is made of these two elements. But the carbo-hydrates and albumenoids are all important if we are to feed them to our animals. You will find that plants have greater need of certain organic elements than of others. This is given in per cent. Meadow hay has of albumenoids and nitrogen compounds — 95.5 is albumenoid, and 43.6 is carbo-hydrates; Red clover is 11

per cent. albumenoid, 35.1 per cent. carbo-hydrates; White clover 14.9 per cent. albumenoid, 37.4 per cent. carbo-hydrates; Timothy hay 6.2 per cent. albumenoid, and 47.5 per cent. carbo-hydrates; Corn stalks, 7.5 per cent. albumenoid, 56.2 per cent. carbo-hydrates; Oat straw .4 per cent. albumenoids, 36.6 per cent. carbo-hydrates; Potatoes 2 per cent. albumenoids, 23.7 per cent. carbo-hydrates; Mangelwurzels 1.1 albemenoids, 10.1 carbo-hydrates; Turnips 1 per cent. albumenoids, 5.2 per cent. carbo-hydrates; Indian corn 10.6 per cent. albumenoids, 72.2 per cent. carbo-hydrates; Oats 9 per cent. albumenoids, 62.9 per cent. carbo-hydrates; Linseed cake 25.5 per cent. albumenoids, 45.9 per cent. carbo-hydrates; Cotton seed cake 42.9 per cent. albumenoids, 35.9 per cent. carbo-hydrates; Wheat shorts, 12.7 per cent. albumenoids, 65.3 per cent. carbo-hydrates.

Now I think I have gone far enough to give you an idea of the composition of plants. We grow plants — I think you mostly do in this latitude — not to sell plants as plants, but to convert them into something else, and sell something else as the product of the farm — beef, pork, mutton, cheese, butter, milk, etc. That is the crop you sell from the farm rather than the plants themselves. Therefore you must convert these plants with this varying composition of organic and inorganic matter, albumenoid and carbo-hydrates into something, some crop that suits your circumstances. Well, for the farmer to get whatever his selling crop is, whether it is butter or fat for the animal carcass, or milk as milk, the quality and the quantity you can get from the animal will depend very materially on what you feed. All this must be contained in the crop, albumenoids, oil and other materials. So it comes to be a matter of a good deal of importance now, what it is most economical to feed the different kinds of stock, and for different purposes for which he keeps his stock. Now we will go a little farther; Topsy "thought she growed," and our animals grow. But most of you know that there is nothing in the animal system or carcass in any form, or any place in its existence but what all there is there came from the plants.

You ought to remember that the animal, whatever that animal is,

is simply of a make-up, just like the plant, and of the same material — passing through certain changes in obedience to the laws of life, and so is your organic matter that came out of the soil, and the inorganic matter coming out of the air, passing through some changes in order to make a plant. The animal takes the same materials and in obedience to the laws of animal life it changes them over somewhat, but the fact still remains the same, and the animal system is built up of precisely the same materials, exactly the same thing — ash, carbo-hydrates, albuminoids, — and the whole animal system, it may be the human system, or anything else is made in the same way. The animal system is continually changing, undergoing changes.

There is waste in the system in every way whatever may be the requirements of the animal, in every way there is a waste. But it varies; under some circumstances more than under others.

Let a horse stand in his stall doing nothing and the waste of the system is but very small. But take him out and put him over the course at a 2.40 gait and the waste will be enormous; the total waste of albuminoids, carbo-hydrates and ash, for they are all being wasted, day by day, and more is being supplied of the same materials, ash, albuminoids, carbo-hydrates. They are derived from the plant which he takes as food. Now, if you are familiar with this way of treating the animal system there is not anything wicked about it, it will be all right. In order to ascertain these facts many and many an animal has been subjected to a course of analysis and treated precisely the way that plants have been. Hundreds and hundreds of animals have been analyzed, and the whole carcass of all our domestic animals of every kind and description. Now, you will find—take a fat ox to illustrate it—you will find that the carbo-hydrates of the whole carcass, that is the fat and the materials that come from that class of matter is 26.8 per cent. carbo-hydrates, and the albuminoids nitrogenous portion, and I might say that the albuminoids of all animals are found in the muscles. The albuminoids are 13.7 per cent., and the ash is 4 per cent. It is not needful that I should go on and state the composition of the ash, that is sufficient. The ox is made out of 26.8 per cent. carbo-hydrates, that

is principally fat in the fat ox, and the albuminoids 13.7 per cent and the ash 3.9 per cent.

We could go into details and give the analysis of the animal system the same as we have the plant itself. Now, then, we see that we have got in every animal just exactly what we have in the plant. They do not always call it by the same name; they will say, perhaps, instead of albuminoid, when it comes into the animal, fibrin, or some name of that kind, it is practically one and the same thing. Plants made from air and soil, animals made from plants—that is where we stand. Now, you begin to see, perhaps, at what I am driving? At the present time and date farming is so very close that every man on the farm to succeed has got to come down to the finest possible detail. Nothing must be allowed to go to waste.

It is all important that every particle shall be consumed in the most economical way, that it shall be fed in such a way that the very most shall be got out of it. Now, take an example; the carcass of an ox takes a certain amount of albuminoid, that albuminoid would not be available if it did not have also the carbo-hydrates. Supposing you take an animal and feed him entirely on the albuminoid, he would die for want of nutrition, however much you might give him. Suppose you turn it the other way, feed him entirely on starch, give him nothing but starch, he would starve to death, because he must have something besides starch in his system. So, if you feed any animal out of proportion, the success or the growth and development of the animal depends on the proportion of feed. If you feed a milch cow in a certain way you get a disproportion of milk. Some of you make milk, if you want to get a large quantity of milk you will feed one way, if you want to get first class milk you will feed another way, and the tables of the different materials are a very good guide to what should be fed to make the best milk.

And here comes in the value of these tables in relation to feed, they give certain information affecting the quality of the product we wish to produce. Now, these are all matters of detail that the farmer may find it extremely difficult to work out for himself. The table is a good guide

in relation to feeding his crops to the different animals of the farm, such animals as he wishes to make the subsidiary product. The whole of them have been worked out after long and extended observation at the agricultural experiment stations. Every farmer can procure one of these tables, and have it by him as a guide to learn him how to feed economically the different classes of stock for the different purposes. I will give you here what has been agreed upon.

After long trial and experiment it has been found that oxen at rest in the stall and doing no work, standing still in the stall and remaining in their present condition, require for their maintenance for every 1,000 pounds of live weight the following substances in the following proportions, and this is taken dry: An ox of that weight requires daily 17.5 pounds dry substance—we do not say what the substance is, it makes no difference—which dry substance must contain 7 pounds albuminoids, 18.5 pounds carbo-hydrates. For the keeping of the animal in his present condition of bodily weight such an animal must have daily 8.85 pounds of nutritious substance, albuminoids and carbo-hydrates, a little less than 9 pounds. Now, the same animal working hard, and when you work an animal there is a great waste of the system, to keep the same weight he will want 26 pounds a day dry substance. Well, perhaps, I should say here—some of you, gentlemen, who understand your business would say you want about 30 pounds of good hay a day, 3 per cent.—here, you see, we give it less because we give it dry, water being taken out. Oxen working hard, 26 pounds dry substance, and that must contain 2.4 albuminoids, 13.7 carbo-hydrates.

Milking cows 1,000 pounds in weight require 24 pounds daily dry substance, and that dry substance must contain 2.5 pounds albuminoids, 12.9 pounds carbo-hydrates or 15.3 nutritive matter. Now the fattening ox; I have but two more—the fattening ox and the working horse. The fattening ox in weight 1,000 pounds requires 25 pounds dry substance, containing 2.7 albuminoids and 15.4 carbo-hydrates or 18.2 nutritive matter. The working horse of 1,000 pounds weight requires dry substance 25.5 pounds, and that must contain 2.8 albu-

minoids and 14.2 carbo-hydrates or 17 pounds nutritive matter. With this knowledge classified and tabulated, and available to every man, it seems to me that, although you do not feel inclined tö go into the experiment of the feeding with all the detail that has been indicated, I feel absolutely certain that there is not a farmer in Rhode Island but what can reap most decided advantage in the matter of feeding stock and the improvement of stock by following the leading ideas that have been laid down to us. I know some farmer will say, "It is preposterous business to tell about my making use of those tables." Any more so for you than for your brother engaged in some other business? Can't you do it just as well as any other man does? Supposing one of us sent for a man to come and survey a lot of land we are about selling, to tell us how much there is of it, will he go to work and survey it and run it out and tell you what the area is without resorting to his tables! He may be an old surveyor and yet he won't measure and give you the area of a lot of land anywhere without going to his tables. He comes and goes around the land and he tells you he will work this out and send you the result, and he goes home and takes his tables, and works out the area by the tables and sends you the absolutely certain exact area of the land he surveyed. Can't you do the same thing? Haven't you got as much at stake? So you should take the same pains as this man takes in getting the area of the plot of land. There is no reason why any farmer cannot do this and reap a most decided advantage from the knowledge which has been gained after long experiments and investigations and long experience in the matter of knowing our food constituents as they are required by the animals upon the farm that we feed for different purposes.

Now, there is one thing more and I have done. We can't feed our animals till we have made the crops—that is the next thing. I think I have already said that all crops are made in the same way—always the same materials in the crops and the different qualities of crops are made by the different proportions of the different elements which enter into all crops. This is simple. Every plant that grows must have all these eight elements of inorganic matter in it. Every

plant that grows must have the four elements of organic matter in it, and they must have them in certain proportions. Now the plant is precisely like the animal, and, as I have said, the animal is like the plant, and for a man who undertakes the feeding of animals it is not necessary that he should feed everything that enters into the composition of the animal. Although this material enters into the composition of animals there is no mention made of feeding animals with ash. The result of practical experiments is this. That any of the plants that have been named as suitable feed for our animals, all of them contain a sufficient quantity so he can get all he wants. We need never feed any mineral matter for the sake of its entering into the animals composition, except occasionally a little salt, and that is not a part of his composition. Salt is necessary in the system for other purposes. So that the farmer feeding his stock need not fear they will want mineral matter. Now, then, when we come to talk about making our plants. I suppose it is agreed upon, I don't know of anybody that disputes it to-day, that certain elements enter into the growth of a plant that are indispensable to the plant, but are matters of no concern to the farmer, because they are supplied abundantly by nature, they cost nothing, the world is full of them, and they are always accessible to the plant, and the farmer need never pay any thought to them. Never make any expense in providing his plants with certain elements. He need never feed his plants with anything that shall make carbon. The atmosphere has carbon and the plant takes it and converts it into the plant, starch, sugar, &c. We need not look out for the carbon, oxygen or hydrogen, for the plant can get them from the air and water.

So that to-day, I think, we all agree that for the growing of plants—with perhaps some few exceptions in relation to certain specific plants—that all the farmer need look out for in feeding is to provide them with nitrogen of the organic elements and potash and phosphoric acid of the inorganic elements. That is all we need to look out for, we can grow our plants in the best manner and the largest growth if we will provide them simply with nitrogen of the organic element, potash and phosphoric acid of the inorganic, but you must give your plants these

substances in an available form, mark you, and enough of them, and you will produce the largest and the best crops. We may pursue our course with the growth of plants precisely as we have pursued our course with the growth of animals—feeding animals for certain results, so we can feed our plants. Now it is plain that there are but three elements, and we can feed our plants with them. We can accomplish certain results by feeding simply these three elements. I know I shall step on debatable ground, perhaps, but on which, however, I feel perfectly strong and perfectly free, and that is that if I feed my plants on potash, nitrogen and phosphoric acid in available forms—does it make any difference what proportion I have in the compound of nitrogen, potash and phosphoric acid? Does it make any difference in the proportion between the albuminoid and the carbo-hydrates? Suppose I should feed my animal on starch, would the animal live? No. Suppose I feed my plant on nitrogen, will my plant grow? No. It does not make any difference how much nitrogen you give your plant, if there is a deficiency in potash the plant will stop growing when the potash is exhausted. If I feed any quantity of nitrogen in any of the forms in which we give it to plant, and in immense quantity, my plant will stop its growth when the phosphoric acid is exhausted. So that the measure of the fertility of the soil may be the percentage of phosphoric acid available for the use of the plant. Then it comes to be a matter of a good deal of importance if we need nitrogen or phosphoric acid in an available form, to tell us how these substances shall be compounded. It cannot be said that it is a matter of utter indifference so that there is a compound of nitrogen, phosphoric acid and potash in one way or another. It must be compounded in such a way that the plant may with all three of these elements get the natural normal development. Being perfectly matured it shall be able to make its root, its stem, its leaves, its flower, and to send forward that material to perfect the seed, and when the plant is ripe and the seed perfect the perfected plant gains its normal natural condition, and in general that plant in the seed, in the leaf, and in the stem determines what the want of the plant is. I think, therefore, I

would produce plants by these three elements. Compound them in such a way that the best possible result may be attained. And that, you see, is a compound of them as the natural well developed healthy normal plant contains these elements, certain per cents. of nitrogen, phosphoric acid and potash in available forms.

It seems to me it is the common sense and business-like and practical way to get at the best that we can do in the production of plants, and we learn it all by knowing about the composition of plants. Now, it occurs to me I have forgotten one thing which I should mention, and then I will close. In feeding these materials to our cattle or our farm animals of any description, if you watched closely the tables that I read, some of you may ask what had become of the rest of the material, giving a very large proportion that does not show in the per cents. Now I should say, that it may be intelligible, that the large per cent. of gross food we give our cattle does not appear in the actual nutrition. The actual nutrition is one thing, the gross material fed is another. We feed 26 lbs. of air dried material; but the albuminoid and carbo-hydrates were only so much. This material is not all available, it is not all truly and completely digested. A part of it is thrown off as waste, and the discrepancy between the amount of material fed to the animal and the amount of nutrition taken up is the waste in the system. So that that must always be accounted for. All the material we feed our animals is not nutrition, a portion of it is waste, and that waste, of course, we utilize by sending back to the farm; and so the same rule holds in relation to the materials we feed our plants. Plants do not consume manure as manure; they do not eat potash and soda and phosphoric acid and lime as those materials, but take them when made available by solution. A plant may send its rootlets directly down into the phosphoric beds of the Charleston Basin; its roots may ramify all through the phosphate nodules, and yet the plant die for want of phosphoric acid, because the material is not available. So that when you feed the plant or the animal, you must remember that in order to get the most of it, it must be given in such a form that the largest possible per cent. is available. Now, if you haven't got tired, just one

more application. It is a question which the farmer often asks. "When is the best time to cut and feed these crops? A. is going to let his grass stand till the seed is ripened, but B. just as it comes into blossom." And so there are all ways and notions in relation to the proper time to cut certain crops, so he may get the most out of them. The tables that have been read, and these are simply a fragment taken out here and there from the whole mass of tables—these tables show conclusively, that at certain periods of the growth of the plant the elements of nutrition are more available than at other periods. I should cut good hay quite green and before the materials that make the seed is transposed from the stem and the leaf to the seed. It is then the most easily digested, and the nutrition is most easily available. Whereas, if I let my crop stand till the material that makes the seed is transposed from the stem and the leaf into the fine, hard seeds of our grass—they are encased and encoated with material which protects them so well from moisture, it is very rarely moistened in the stomach, being very rarely masticated by the teeth, the animal very rarely digests it—we will find we have lost a very large per cent. of our crop as a feeding material. If we allow it to stand till it has passed to the ripening of its seed, we lose the best of the material of its structure that would have been in it if it had been cut in blossom rather than when the seed was ripe.

Now these are the inferences that I draw from a knowledge of the composition of plants. I think, from this knowledge, we ought, as farmers, to draw a great deal that is of practical use and benefit. I am obliged to you for the close attention you have given me.

Mr. Hawes. I would like to ask in regard to milk, what the best feed would be to keep the cows, and get the best quality of milk?

Prof. Stockbridge. Will the gentleman state a little more clearly what he means by the best quality of milk. Milk for selling in town or milk for butter?

Mr. Hawes. For both.

Prof. Stockbridge. I suppose, if the gentleman is in the busi-

ness of making good, nice butter, to supply families in Providence, the very best thing that he can feed his cows for that purpose will be what we call English or blue grass, cut early, and an addition of Indian meal with it; that will make you the best butter. If, however, you are making milk to sell in town, and want it should be good, rich milk—Jersey milk—use cotton seed instead of Indian meal, and then you will get the quality of milk that will suit your customers first rate; but rather have the Indian meal for the butter than the cotton seed. The effect of cotton seed on milk is to make it a good deal like Jersey milk in color and taste.

MR. PECKHAM. How is pea meal?

PROF. STOCKBRIDGE. Pea meal is about between the Indian meal and the cotton seed. The cotton seed is very rich in oil, while Indian meal is called one of our fatty grains, yet it has only six per cent., while cotton seed has 26 or 27 per cent. But if your business is making butter, and you feed the cotton seed, it will affect the quality of your butter injuriously. It has been my experience.

MR. HOPKINS. I would like to inquire if I understood you in the opening of your lecture, that the moisture was derived entirely from the roots of the plant and the nutriment from the leaves, or whether there is any moisture provided to the plant through the leaves?

PROF. STOCKBRIDGE. Now, practically, a plant gets all its water from the soil. At the same time, it is true that a very small per cent. of water can be absorbed by the leaf, and would be soon absorbed through the green bark, but it does not amount to anything. It is true that it can be done, but the great source of the moisture of plants is the soil; but all the soil food, and some of the organic food of the plants, comes through the roots from the soil. It is only the organic matter that comes out of the air, and that in the form of carbon a small per cent. of nitrogen is taken out of the air

in the form of carbonate of ammonia, but the quantity is very small indeed.

MR. HOPKINS. I have seen plants dry up in the heat of the sun, and the next morning we found them fresh and green. The impression is that they get moisture from the dew.

PROF. STOCKBRIDGE. No, sir, nonsense; that is what we want to understand. Well, we don't want to go into the discussion of what dew is and where it comes from, for I should not agree with the world as to where it comes from. I said that there was a remarkable connection between the root and the leaf. It is the business of the root to pump water up to the leaf; the leaf throws nearly all the water off into the air. Now, then, there should be a perfect balance between the two, if the plant is in its best condition, and yet if the soil is a little deficient in moisture and the air is hot and dry, the increased temperature causes a rapid evaporation, and the balance between the root and the leaf is destroyed. When the sun goes down then the evaporation is not so great, and the root pumps up the necessary moisture and the leaf becomes turgid. Not because of the dew, but because the roots now can equal the leaf and they pump up enough to keep it turgid.

MR. T. G. POTTER. Did I understand you the plant could not substitute one element for another, any way?

PROF. STOCKBRIDGE. I don't think it can, ordinarily. I know it is claimed that you can force a plant to take soda when it can't get potash.

MR. POTTER. I believe that some 35 years ago Liebeg did it. I know his satellites talked a good deal about it, that when there was a deficiency of potash they would, in a measure, take soda. We know, sir, that along shore where they can't get potash they use sea manure, or soda, the next best thing.

PROF. STOCKBRIDGE. Now I will answer that question right here. Liebeg's disciples tried to prove that a fact in this way. They

made a soil from which every particle of potash was eliminated. They were careful to see that nothing went into it; distilled water was used, and they fed that plant, which was a buckwheat plant, with soda instead of potash. They went through and produced a beautiful plant, and then went around and said that soda could be substituted for potash. The question was asked: "Did you analyze the buckwheat after you had grown it to prove it had no potash in it?" "Why, no," they said, "they didn't think of that." Now, then, that experiment amounted to nothing, because the potash might have been formed from the material they had in there—clay and sand—enough of it.

MR. POTTER. Would the potash be eliminated from the clay or the sand?

PROF. STOCKBRIDGE. Probably from the sand, because you might have had in the sand, you know, silicate of potash, or feldspar in it.

MR. POTTER. I believe it was stated not long since in this hall by a lecturer, that the soil would not retain nitrogen. There was a question asked if it would, and he said it wouldn't. I thought he hadn't left it very plain for we poor ignorant farmers, and that it was rather hard for us to suppose that the Almighty, in making this world, didn't know how to make it so that it would stay put for a time, and he said that he should have qualified it, there were certain substances—

PROF. STOCKBRIDGE. Now I don't know who the lecturer was—

MR. POTTER. I don't wish you to know.

PROF. STOCKBRIDGE. I don't care who he was. He may have used an expression carelessly, and he, perhaps, may agree with me perfectly, but he may have used his expression carelessly. He said that nitrogen could not be contained in the soil, whereas we get the nitrogen in a great many different forms. We have nitrogen in the form of nitric acid and sometimes gas nitrogen in the air.

Nitrogen in the form of ammonia. Now it may be possible that pure gaseous nitrogen may not be retained in the soil, but if that same gaseous nitrogen was changed to ammonia we know that it is retained in the soil. There isn't a fool anywhere that ever knew what it is, but what knows he can keep ammonia in a certain way, and a certain per cent. of it is nitrogen. Now, then, if it takes another compound form it is united with a certain per cent. of oxygen and takes the form of nitric acid, and that can be retained in the soil. I don't know what the lecturer meant by saying nitrogen, but certain it is that nitrogen, in the form of nitric acid, in the form of ammonia, is retained in the soil. Why, if the Almighty didn't know how to make this world, I don't believe the chemist can find out. I believe the different elements were put in the soil—this may be faith, I couldn't prove it—so that this earth should remain fertile in all time if you could keep man off of it. Man is the devastator of this soil; if you leave it, soon it will grow fertile; if he will move off and leave it, nature will make that soil fertile in due time. This earth would have been a desert if nitrogen could not be retained.

Mr. Potter. A gentleman in the room said he had been reading the reports of the experiment station, and he found there that the underground drains let the nitrogen off—you have seen those reports, of course—and he asked the lecturer if the soil would not retain nitrogen, and he said it would not; and I thought, it seemed to me, he was teaching us poor, ignorant farmers incorrectly, because his teaching was that the Almighty didn't know how to make the world, and I thought he did. Then he was asked if certain materials in the soil would not hold nitrogen, and he said he should have stated it a little differently; it would not do to say that these drains would get all the nitrogen we put on top of the ground.

Prof. Stockbridge. I will state, sir, the subject is not a new one to me. I don't know whether you have seen the reports of the

Agricultural College, '79, Amherst. This very thing was tried exhaustively there by the use of the lycimeter. If the gentlemen are not all familiar with it, I will tell it in detail. I put one in at the college; it was made of a size just sufficient so it held $\frac{1}{3000}$ of an acre. It was put into the soil without the soil being disturbed, so that the soil should be in an absolutely natural condition. The bottom was put under and the sides were put on, and the soil not disturbed on top; then a gauge showing the amount of water fall, and after every rain we knew exactly how much water was put into the lycimeter, and then all the water that trickled down four feet in the soil, every particle of water was caught in jars at the bottom. Now, then, a great many things were to be learned from that lycimeter, but one was this thing. We kept the lycimeter going several years, and we put in different materials to see how they comported themselves toward the soil. We put in potash, and after we had four or five rains, or till water ran through in sufficient quantity, the water was analyzed to see if there was any potash in it. None whatever. Then some other substance was put in, and after water had gone through sufficiently that would be analyzed; and so we kept on, and we found no potash, no phosphoric acid, nothing we applied, only a little bit of nitric acid.

QUESTION. I would like to inquire what the soil was.

PROF. STOCKBRIDGE. It was the poorest soil you ever saw; the first ten inches was gravel; it was very miserable coarse gravel, and very coarse at the bottom; what any farmer would call a miserable soil.

QUESTION. I want to ask you if Topsy wasn't pretty near right when she said, "she growed."

PROF. STOCKBRIDGE. I think she is excusable, but I don't think everybody is when they think they grew.

MR. POTTER. Well, I think the poet was pretty near right when he said, "All flesh is grass."

Mr. Hawes. I would like to have you teach us how to feed salt to animals to the best advantage.

Prof. Stockbridge. Now that is a question that has been talked over a good deal. Mr. A. comes up and says: "What ails my cattle? I don't believe they have salt enough." Another one comes and says, "How much salt shall I give my cattle? My hay was got in rather damp and I salted it, and it seems to me my cattle have not been doing quite so well." Now, my belief is that the animal is the judge of its own wants—if it is healthy—and if animals have all the time salt accessible, they will never eat any more than nature requires. If you take a sheep and keep it without any salt for three or four months, and then let it have full and free access to it, it will eat enough to kill itself; but if they have salt by them all the time, in the hard lumps of rock salt, if you please, and let them supply themselves as the system requires it, it is used in the system, I believe, as an absorbent. I should say to a young man who didn't know anything about these matters, I should say, "Get your animals into a normal condition, then put the salt by them, and you never need fear that they will ever eat enough to hurt them."

Mr. Hawes. I have one animal that won't touch it.

Prof. Stockbridge. Have you? Then it does not need it.

Question. Why doesn't one need it as much as another?

Prof. Stockbridge. That I cannot answer you. It is too much for me.

Mr. Louis Winsor. I would like to inquire where such tables as you spoke of can be obtained in a condensed, simple and comprehensive form, so that they can be understood and available to ordinary people.

Prof. Stockbridge. Well, they are found in various books. I have one with all the tables, everything extended, and yet perfectly plain, with a good deal of animal physiology in it to show

you the reason why. They will be found in "Armsby's Manual of the Law of Feeding," which you can get, I think, at almost any book store; I think you can. But if you go to the Agricultural Stations now-a-days, feeding experiments are going on all the time on that system. But you can get "Armsby's Manual of the Law of Feeding."

QUESTION. In connection with the soil which you spoke of, when you have such a soil as that, what is the best thing to restore its fertility?

PROF. STOCKBRIDGE. That is a big question, but it is a very proper one. What is the fault of such soil? It is too open, too porous. Organic material put on to that soil is hastened to its decomposition with the greatest rapidity, and when it decomposes it changes to a gaseous form and goes off in the air. That is the fault of that soil. Now, then, if you could afford to mix it by taking a soil that has the opposite fault—that is, too hard, too compact, and does not let the sunlight in and so the decomposition does not go on fast enough—if you are so situated that you can afford to mix these two soils together—if you could afford to cart the sandy on to the clayey, and the clayey on to the sandy, you would cure the faults of both soils. And that's where the rub comes. Can you afford it? Have you got the clay bed adjoining your sandy farm? It costs a great deal to make land. You know Henry Ward Beecher said that if a man didn't believe it was a big job to make this world he had better go to work and grade up a hill and he would soon find out it was. If you can afford to do that—if you have got clay near that light soil, where the fault is that it is too porous—if you have teams and it were in the winter when they would not otherwise be profitably employed—it would be best to cart the clay to the sand and the sand to the clay. The next best thing to give it a retaining and absorbing power is by mixing with it more organic matter. One of the cheapest things

to do is to plow in green crops—plow in clover. Perhaps your land is so poor you can't start anything to plow in. Take rye, take buckwheat. When you get so you can start clover on it, you need not be afraid but what you can cure it then. These would be my methods.

MR. HAWES. I would like to ask how long it would take clover plant to penetrate down, and what time is the most proper to plow the roots as fertilizer?

PROF. STOCKBRIDGE. A clover field was sowed in the spring of 1884 with oats. In July, 1885, it was mowed. In June, 1885, it had the clover plant washed out, and the deep root of that clover plant was eight feet and six inches in length. That was in the alluvial soil. Now you asked about the time to plow a clover crop to get the most advantage from its root development. I should say let it stand two years, if your land will retain clover. But if you can't get it two years' old, mow two crops the first year, and then mow one crop the second year, and then plow in the second crop. Every time you mow the clover you check the growth of the plant, and then it starts and throws out more rootlets.

After passing a vote of thanks to the speaker, the meeting was adjourned.

FOURTH LECTURE.

The fourth meeting of the series was held February 11th, 1886. The meeting was called to order by Secretary Smith in the following words:

MR. SMITH. Next Thursday afternoon the Hon. James J. H. Gregory of Marblehead, Mass., will address the meeting on the value of Commercial Fertilizers in comparison to Barn Yard and Stable Manures." Our lecture last week was postponed on account of the death and funeral of an honored member of this society, Joseph F. Brown, Esq., and consequently there has been a vacation of two weeks since we held our last meeting. We intended last week to give you the report of the experiments at the State Farm during the past season, and they will now be given two weeks from this time, probably.

The Bee Keepers Association have asked that they might be allowed the privilege of occupying our rooms at some time, and to-day they will, by invitation of the lecture committee, occupy our regular Thursday afternoon meeting. I will call upon Dr. C. D. Wiggin to preside during the rest of the session.

DR. WIGGIN. We are very glad to be here, but we did not wish to assume control of the meeting, and we hardly supposed that we were to do so. I should much prefer that the Secretary of the Society for the Encouragement of Domestic Industry would have presided. We appreciate the invitation to be here, as we have no abiding place of our own. It is known to some of you that the

Rhode Island Bee Keepers Society has been formed only two or three months, and as yet we have no regular place of meeting. It was thought best to form this Society for two reasons; in the first place that we might become better acquainted with one another, and with the improved methods of bee keeping; and in the second place that we might discourage, as far as possible, the production of adulterated honey. There has been inquiry on the part of some as to how to obtain the bees, and there has been a disposition in the community to enter the business to a limited extent, for it is very evident that we need not have a farm to keep bees successfully. There are some ladies in the community and in the city who would be glad to keep bees on a small scale, but they know not how to obtain the bees, and they know still less about the improved methods of tending them. It is then for this two fold object that we have an excuse for our existence. It would seem that bee keeping is certainly one branch of "domestic industry" and it may not be that we are out of place here to-day. In regard to the adulteration of honey; it may not be known to those who are not very well acquainted with the production of honey, that this has been practiced more or less for a long while. You see in the market two forms of honey, — the adulterated or rather the extracted honey which you can see could readily be adulterated, for honey like that which comes from the extractor can easily be mixed with syrups or glucose, and be put upon the market by unscrupulous dealers or producers, and those who are not acquainted with it may buy it with no suspicion that it is adulterated. The method of adulteration, which I have already referred to, has been carried on to an extent which has interfered with the business very seriously. There has been an attempt to introduce honey into various branches of business where sweetening is required, and I noticed in the last report of the Bee Keepers Society of Detroit, recently, that there had been packing houses in Chicago who

demanded a large amount of sugar syrup, for the curing of ham more particularly, that had found they could obtain the greatest amount of sweetening at a reasonable price from honey, more cheaply, more quickly, than from any other source, and quite a demand for honey, more particularly the extracted, had been created in Chicago. But they have since found the honey was not satisfactory ; it did not produce the results that had formerly been obtained, and on investigation it was found that the honey had been adulterated, so they discontinued its use and went back to the use of syrup or whatever they had formerly used. It was regarded as unfortunate that this should have occurred just as a new demand was made for the honey which was very much desired. It was very much to the injury of the bee keepers or those who produced honey. It was as much harm to the bee keepers, perhaps, relatively, as the production of bogus butter and cheese to the dairy interest. Of course the dairy interest is an enormous interest, involving great capital and thousands of people throughoutd the country, and as that has been injured by the production of bogus butter and cheese, so the bee keepers interest has been injured to a corresponding extent. Of course the interest in bee keeping is relatively small. Now while it is true that extracted honey has been adulterated for some time, it may not be generally known, perhaps, to those who are not acquainted with bee keeping, that at the present time the fancy article of comb honey, as we find it in the market, is adulterated to as great an extent as has been practised upon the extracted. Many suppose that if they buy a section of white comb honey they have something that is genuine. But that does not necessarily follow; for if bees cannot obtain a large surplus of honey from the flowers, if the flowers do not secrete honey readily, as they do not at some seasons of the year, or some years, they will readily appropriate whatever form of sweetness is given to them. So taking advantage of that fact, many have fed

their bees largely with sugar syrup, and have thus been enabled to produce an enormous amount of so-called honey, which has been placed upon the market at the price of good pure honey. To be sure there is a peculiar aroma to good comb honey which may deceive those who are not acquainted with it to a certain extent, although one acquainted with honey can easily detect from the color and the smell, more particularly from the taste of the honey; but as he is not allowed, of course, to sample honey in the frames as he comes to it, as that would destroy its merchantable value, he often buys honey which is simply sugar syrup, or glucose, which is worse, stored in pure comb.

Now one object in organizing this society is to overcome this pernicious practice. How far we shall succeed is a question, as I said formerly, bee keeping is a subject of interest ; it is one of considerable importance; it is something that most people are fascinated with, if they become acquainted with it in its improved method. We should not want to keep bees at the present time, they way they were kept a generation or two ago. There have been great improvements in that respect as you will see ; the old method of keeping bees was to allow the bees to swarm into a box hive, if they could be secured and put there, and at the end of the season the top of the hive was taken off, and portions of the honey removed and part of the young bees with it, perhaps some pollen. There would be a good per cent. of honey that was not merchantable, but it would seem now worse still, the cruel practice of destroying the bees—thus killing the goose that laid the golden egg. But that has all passed away among intelligent bee keepers, and we should no more think of going back to that than would the farmer to the old style of cultivation of the soil without the improved methods, or without making a careful study of all that pertained to fertilization and the growing of crops for the market, etc.

The modern method of bee keeping has been revolutionized by the movable frame hive, which you know — for I suppose I am speaking to some who are not thoroughly acquainted with bee keeping — is a frame hive, by which a portion of one hive can be taken and placed to another, thus affording every advantage to successful bee keeping. I will not go into any detail as to that because I don't know but what the speaker to-day may refer to it, but that has certainly been one of great advantage; the greatest advance to bee keeping that has been made at any time was the introduction of this movable frame. Then there has been the honey extractor, a machine for extracting the honey from the comb, which has afforded a great advantage, and of which I will not speak. While we would encourage bee keeping we would do it with certain reservation, for we feel that the business has been overestimated in the opinion of some. It has been painted in rose color, oftentimes to the injury of those who have undertaken it. There is not the profit in bee keeping that many have supposed, and yet we would not say it might not be to the advantage of a large portion for the purpose of recreation and study that they afford, and in some years for the surplus which will represent so much cash.

The exaggerations that have been presented to the community in regard to bee keeping have come largely from those who have had bee keepers' supplies to furnish or those who wish to furnish bees. For instance we would say that a hive of bees has made fifty pounds of surplus honey, and that so many hives would produce so much, this honey bringing so much in the market would bring in a handsome income; therefore, every one with proper care may undertake bee keeping, and receive good remuneration, and his accounts balance on the right side. Now while that may be true to a certain extent, it is not true that we have every year uniformly good production of honey; there will be some years when bees will not make any surplus, but owing to the

improved methods of bee keeping, if we find ourselves short of the honey product it can easily be supplemented by syrup for feeding purposes. For we certainly do not discourage the feeding of bees with sugar syrup in an emergency; there are times when it is absolutely necessary to feed bees, even if they have a good supply in the early spring when there is no honey, if there is already a good supply in the hive, the queen will be stimulated to lay more abundantly, and a larger number of young bees will be raised by the stimulation than would otherwise be obtained. So it is an advantage to feed them. I will not take up the time by any introduction of the matter further. I have the pleasure of introducing Mr. W. O. Sweet, of West Mansfield, who will speak to us in regard to bee culture.

MR. SWEET'S ADDRESS.

A colony of bees in complete working order consists of 15,000 to 40,000 bees. In all this multitude of industrious insects there is but one queen or mother bee, which is the only perfectly developed female in the colony, and the thousands of workers as we term them, are imperfectly developed females or neuter bees.

Now to illustrate the different conditions of the colony along through the year, I begin with February. Nature begins to assert herself and show us signs of the coming spring, for the colony has been in a semi-dormant state for three or four months. The queen commences to lay a few eggs near the center of the cluster of bees, first laying within a small circle in one comb, soon extending to two or three combs, and in twenty-one days from the laying of the egg the young worker bee appears.

In March the circle of brood increases quite fast, and by April we see the bees carrying in pollen from the willows then in bloom. Soon the maple and the elm begin to bloom; then comes the first flow of honey. Now the merry, merry hum of the bee is heard within the hive and without, while load after load of the delicious nectar comes

pouring in from the first flowers of spring. As the queen still enlarges the cluster of eggs, extending from comb to comb, she comes to one that has much larger cells which we call drone comb, and is for the purpose of raising several hundred drones or male bees. These neither work nor sting, but being possessed of a capacious stomach are much disposed to eat and grow fat on honey, but their life is short, seldom over four months; and here we might call your attention to the fact that the worker bee lives but three or four months, during the time of flowers, while those reared later in the season live until spring, but none except the queen live to be a year old. The queen lives to be four or five years old, so we might compare the life of the bee like that of a populous city—

> "Though like leaves on trees the race of bees is found,
> Now green in youth, now withering on the ground;
> Another race the Spring or Fall supplies,
> They droop successive and successive rise."

Here you might properly ask how do we have the means of knowing and proving these things? It is by the use of the movable comb hive, first brought into use in this country by L. L. Langstroth, in which the combs containing the honey and bees are all attached to a frame of wood, which is detachable from the hive itself, so that the required number of frames, nine to twelve, can be instantly taken apart, giving complete access to the interior of the hive. Then by the use of a little implement called a "bee-smoker," that is filled with partly decayed wood and burns without blazing, but gives a great deal of smoke, by blowing this into the hive for two or three minutes before beginning operations, it alarms the bees, causing them to fill themselves with honey, and while in this condition they will not sting by careful handling unless they are hurt.

As we come to the month of May, the season of fruit bloom is at hand. The queen is now the most active worker in the hive; hundreds and thousands of bees are hatching every day, while she is constantly traversing the combs and depositing an egg wherever a bee has hatched and left its cell.

This is the time for the bee keeper to be busy also, for as the wealth of the community begins to unsettle the kingdom, new hives must be ready for the swarms that are likely to issue, and more room given to the colony by placing on the boxes for surplus honey, that we often see in our markets, put up so neatly in one or two pound boxes or sections.

By the month of June the colony is running to its utmost capacity, and if given plenty of room to store the honey, and a good field for honey where white clover is plenty within two or three miles, they will often show wonderful results. Natural swarming takes place this month, whereby the instinct of the bees leads them to divide off and form a new colony. By conforming to the habits of the bee this can be accomplished by artificial methods, which if properly done will be as successful as the natural process, without waiting for that to begin; for where many colonies are located in one apiary the intelligent bee keeper can divide a large number in one day, thus saving much time and perhaps loss.

As soon as the bees decide on swarming they begin to construct queen cells like the one I have in my hand. They are built point downwards instead of horizontal like the cells of the honeycomb. We find from three or four of them to twenty in number, attached to the sides and edges of the comb, somewhat like a peanut in shape. An egg is deposited in each of the queen cells which remains three or four days, when it hatches in the grub form, and it is then fed with a white jelly-like substance prepared by the bees, called royal jelly. It is then sealed over in four or five days within the cell, and comes forth the sixteenth day a perfect queen bee, while the worker has required twenty-one days and the drone bees twenty-four days. The anatomy of the bee, wonderful as it is, would comprise a lecture by itself.

Along with other modern improvements we now have the honey extractor and artificial comb foundation. The honey extractor is a machine for removing the honey from the comb by centrifugal force without breaking the comb, which can be returned to the hive for the bees to fill again without the labor of building new comb. This process

can be repeated many times without destroying the comb. I have known of 200 to 300 pounds of honey taken from a single colony during the season by extracting it as fast as gathered This is not common here in the New England states, but it is done in New York state every year, while in California the yield sometimes reaches 400 pounds, and shows what can be done under the most favorable circumstances; but here where we take twenty-five pounds of honey from the colony in the comb by using the extractor, fifty to seventy-five pounds of liquid honey would be obtained by giving it back to the bees to refill while the season of flowers lasted.

The month of July finds the hive teeming with bees and almost filled to overflowing with honey, while the queen is still laying eggs vigorously, for the mortality is great, for it is the height of the season and they literally work themselves to death, as the honey-gatherers and comb-builders appear to be running a race, as the colony is doing its utmost in all departments of the hive. Here we must observe the wonderful economy that is born with the bee. The young bee on emerging from its cell is rather a weakly thing, but it turns its time to good account helping to feed the still younger bees in the larvæ state. After becoming a week old or more it takes the position of comb-bnilder, without serving any apprenticeship, each one is a master workman from the start. It attends to this kind of work until old enough to fly, which is about four weeks. After six to seven weeks old it becomes a honey-gatherer the rest of its life.

For August the condition of the colony remains about the same, and September finds it active as ever, but the queen is now gradually diminishing the number of eggs, and with the bloom of the golden rod and wild asters the honey season is .about over.

Atmospheric conditions have much effect on the honey harvest throughout the season; for instance, when the wind is east little or no honey is secreted in the flowers, while if the wind is in the south, with moist air, the flowers are again yielding honey. I have noticed when we have occasional thunder showers there is the greatest secretion of honey. With these most favorable conditions single colonies in New York state,

when basswood blooms in abundance in July, have been known to gather ten to twenty-five pounds a day for ten days or more, and as the honey harvest from any particular bloom is always of short duration, the intelligent bee keeper will study to make the most of it, so by using the honey extractor at these times with plenty of empty combs to fill, so as to save the bees' time in building it, a large quantity of liquid honey is often obtained.

Artificial comb foundation is now used by all progressive bee keepers, for like the honey extractor it enables the bees to gain time in the storing of honey, and being made of pure wax, there is no objection whatever in using it. Samples of it I have here, and while you are examining it I will describe the process of manufacture. Fifty to one hundred pounds of wax is melted and kept hot, while thin sheets of metal of the required length and width are first dipped into cold water, then into the hot wax, then into cold water again, when the thin film of wax is easily peeled off. It is then passed through steel rolls that are cut with the exact impression of the base of the honey comb. These steel rolls have to be made as exact as a die for stamping coin. This comb foundation is made into thick sheets by dipping twice for use in the brood department of the hive, and only dipped once to make the thin foundation for using in the surplus boxes. It is claimed that a new colony of bees supplied with foundation when placed in a new hive at time of swarming, will gain as much in two days as they would in eight days without it. The invention of comb foundation is said to be the result of German thought and Yankee ingenuity.

I wish to say a few words in regard to an idea that has gone broadcast over the land. Many people already suppose that honeycomb is being manufactured entirely and filled and finished by the hand of man. The most scientific experts in bee culture will agree with me in saying that this thing has not and cannot be done up to the present time. However much an artificial flower may look like a real flower, no one would think of selling it for a real flower.

That honey is adulterated and put upon our markets for sale there is not a shadow of doubt, and it is well known that glucose has been

fed to bees and carried by them into their comb and sealed over, and then sold as pure honey in the comb, but the process is a dangerous experiment; however profitable at first, it will prove ruinous in the end, and if cane sugar is fed in the form of syrup in sufficient quantity to induce the bee to put it in the surplus boxes, it is liable to crystalize and become sugar again within the comb, and is only advisable in time of scarcity of blooms, in order to keep the colony in good condition.

In October and November the colony prepares for its long winter rest. The queen stops laying eggs and the bees do little but fly out on warm days for exercise.

The first product of the bees of importance is honey, the next is wax. This solid, fat-like substance is secreted by the bees in little wax pockets beneath the wings on the under side of the body of the bee. It is always a subject of admiration, so fragile and yet so strong. There are four of these pockets on each side of the bee, and the first we can see of the wax it is in the form of little tumbler-shaped scales, white and very thin. A new swarm of bees has to consume about twenty pounds of honey to produce one pound of wax, and soon after hiving a large part of the swarm hang in festoons and clusters several hours waiting for the wax to form. When fully formed these wax scales are transferred to the mouth of the bee, where by the use of its jaws it is moulded into that beautiful structure, the honeycomb, so wonderfully delicate that it is only about one-thousandth of an inch in thickness and so formed to combine the greatest strength with the least expense of material and room.

Many new and valuable inventions are now in use, and improved methods for accumulating honey, so that to-day we have a new version of the motto—

"How doth the little busy bee,
Improve each shining minute,
And gather honey all day long,
Because there's millions in it."

I hold in my hand one of the small section cases, such as we place in the hive for gathering our surplus honey. These little sections hold about one pound of honey each. I presume you have seen them in the

market; it seems to be the most saleable form for honey to be put up in. A few years ago there was a prize of $50 offered for the best sized box for the New York market, and at that time they selected after many trials, what they thought to be the best — a box holding about two pounds, like this I have here. This is called the prize box — the prize section — and meets with a large sale, yet the one pound section meets with a larger sale.

Now I have here four combs as we term them, attached to the frames by the bees. This was first a piece of their foundation, as you see as I hold it in my hand, attached merely by a thin strip of wood at the top of this frame and placed in the hive. I have placed them in the hive myself several times; for instance at 3 o'clock P. M., when honey was being gathered quite rapidly, and at 3 the next afternoon there was sufficient wax added to this to make the cells deep enough, and the honey was placed in in that time, and they constantly elongate the cells till they bring them out the full length, and then you can uncap it from the one hive and place it in the machine and revolve it rapidly around. The combs rest against the wire gauze and throw out all the honey and not break the comb, and then it can be replaced back in the hives, and the bees do not have to stop to spend the time to build that comb over again, it is there ready for immediate filling and in two or three days it is full again — so that accounts for the large yield of honey obtained at the present time. It is not so much here in New England as south and west; but here we obtain three times the amount of honey to-day that we did ten or fifteen years ago by this process.

QUESTION. Why do you place that tin in the box?

MR. SWEET. The idea of placing this tin separator, as we call it, is to have the combs built of uniform thickness, so that they will always be just alike, and pack nicely in the crates for the market. We do not want one comb thick and another one thin, they must be uniform and alike. I will place two of these together and show you how the bees enter. These are two different sizes; there is a crevice of about one-quarter of an inch that they pass through be-

tween the sections to fill them with honey and wax, and then pass through just below the separators, and from six to ten or twelve are placed along side of one another in the hive. Then the heat is economized by the bees and they can work to greater advantage, for the temperature is required to be from eighty to ninety degrees for bees to work, to mould the wax, and some of those very hot uncomfortable days that we have, it seems to be the delight of the bee to work, that is the reason why these separators are used between the sections; sometimes tin is used, sometimes wood, it does'nt make any material difference; tin takes less room. But this illustrates the principle of the movable comb, and no matter what size or shape you have, it hangs in this shape, it is not attached at the bottom or ends.

QUESTION. Is the desired thickness of the comb regulated by sheets of either tin or wood?

MR. SWEET. Yes, in the surplus department, but in the main hive you do not use any separators or anything of the kind. We let them build as they choose there. In making movable combs we calculate they are about one and a half inch from centre to centre; then they will build them nearly all along; they will be wherever their combs lie, more or less in the lower part of the hive. They use these separators as a perfectly flat surface.

QUESTION. Glass has the same effect that the tin has, I suppose?

MR. SWEET. Yes, although glass is not used now till the boxes are all finished for market. We use glass, but we use tin or wood most, and year by year we are doing away with the use of glass, and use tin or wood separators instead.

QUESTION. You used the expression the fields north and west of us are better for raising honey. Why is that?

MR. SWEET. Well, I cannot really say why that should be unless they have more snow. North and west of us the ground is covered longer. In New Hampshire when the snow goes off in the spring

the fields are green, and the grass is ready for the cattle to use. I have noticed up in New York state, in the month of June, in the pastures the grass and clover were very luxuriant, more so than it is here in the month of June, and a great deal more of it, and I have noticed that basswood is more plenty there, is in greater abundance, and I have been in sections where bees were gathering at the rate of fifteen or twenty pounds a day when it was in bloom. Of course that last buts a little while, perhaps ten days.

MR. BAILEY. What is meant by honey dew; has it anything to do with bee keeping now-a-days?

MR. SWEET. No, sir. I think not.

SENATOR OLNEY. Is there more than one kind of queen bee?

MR. SWEET. Not really; no, sir. It is the mother bee of the swarm; she lays all the eggs.

SENATOR OLNEY. Is there an Italian queen bee?

MR. SWEET. Another variety; another species of bee.

SENATOR OLNEY. Is there any difference as to the choice of the bees?

MR. SWEET. Well, we are gradually adopting the Italian bee in this country; several races of bees are being tried; now for instance the Cornelian bee, the Cyprian and Syrian, the Holy Land bee, and some others are being tried. But there is no race that has come into favor so much as the Italian. I was one of the first to introduce them into our section, and I have them to-day.

SENATOR OLNEY. The Italian go deeper into the flower for honey, do they not?

MR. SWEET. It is supposed that they do; they seem to be more prolific than our native bees; they are gradually taking the place of our native bees. I don't know what experiment may prove with the other new races, but Mr. Frank Benton, now in Europe, has tested and tried different kinds of bees to see what results can be reached, and he is constantly sending queens to this country to our most experienced growers of bees.

Mr. Bosworth. What has been your experience in handling the different kinds of bees; the black bee and the Italian?

Mr. Sweet. Well, my experience in handling the black bee has been that they were generally pretty easy to handle and so are the Italians. I would rather handle the Italian than the black bee, and if you get a cross been the races — a hybrid as we call it — you will find it makes the largest crop of honey, but look out for stings, for they are powerful in that respect. I have known a swarm of hybrids to produce 103 pounds comb honey. I never had it done by black bees, or any other bees. The pure Italians are very gentle to handle.

Mr. Bosworth. Have they not some other quality that you can mention as to the bee moth?

Mr. Sweet. They are more plucky to defend the hive against the bee moth. I am glad you called my attention to that. I will speak about the moth. A good many persons speak about the moth getting into the hive and ruining their bees, but it is a condition of that swarm, why the result is brought about. A clean hive with a good healthy queen will not be troubled with moths; but only when the queen becomes diseased, or dies of old age, something of that kind. Perhaps it happens in the winter or early spring, at a time when she cannot produce new eggs in the hive to produce a queen bee, and your hive is absolutely queenless, and the bees gradually grow less and less day by day, until there are but a few bees left. The moth egg is always around in some part of the hive during the summer months; the moths lay their eggs about the entrance of the hive, about the cracks and crevices, wherever they can, and the bees unconsciously carry those eggs into the hive on their feet, and we find them clear in the surplus boxes, and after taking the tops off we have known them to hatch out and produce a little web, perhaps in one corner. So that as long as a vigorous queen is in the hive, you need have no fear of moths of the Italian variety.

Dr. Wiggin. It might be interesting to those present if you would explain the advantages of a frame hive in swarming.

Mr. Sweet. At the time of swarming, for instance, we watch over our hives patiently, and want to go away for a day, perhaps we do; out goes the bees and away they go to the woods. This is where the movable comb hive comes in play. The weather becomes warm and the hive is full of bees, say in the month of May or fore part of June. We will select a hive we think is about ready to swarm, or nearly so, which hive we will say contains from nine to twelve of these mov*a*ble frames. For instance, we want to make an artificial swarm. We first place an empty hive near by, take out two of these frames, look them over and find the one that has the queen in it — in the movable frame she is very easily found — five minutes is enough to find the queen, she being so much longer and larger she is easily picked out, and having once seen her you would easily see her afterwards. Then take from the hive two frames, the bees and comb as they hang on them; place them in the new hive with the queen. Now mark what I say, take two empty frames out of the new hive and place them in that hive where we took the two frames from in the first place. We will place that new hive on the stand where the old one stood, and will move the old hive to a new location about the yard, where we place it will make no difference, and in twenty-four to thirty-six hours this swarm will divide itself as completely as if it was done naturally; but the old hive has the majority of the frames with honey, and comb and bees, and there are thousands of young bees hatching all the time. Then there is a large quantity of bees gathering honey, and they fly back to the old location; so consequently that builds up your new hive — the one that has got the two frames and the queen — that builds them up and makes an even swarm of it. Well, of course they have to come from the other hive themselves, and it seems to be one of the traits of the

bee to fly to its old home. But the young bees hatching by the thousand every day, soon bring up the other swarm, and a good many that can't fly of course remain there, so that in a few days it is as strong as the other, consequently that plan works every time.

MR. BOSWORTH. Do they make a queen in the meantime?

MR. SWEET. If we find one that is nearly ready to swarm, queen cells already started, it is much easier, you will work to greater advantage than you do without it; but we will say there is a queen cell already started. We will look out and place the queen cell in the hive without the queen, and only the combs with honey and bees in the old hive, so that in a few days the old queen hatches, and as I said there are several queen cells started, but the first one that hatches if she suits the bees, they will destroy all the rest, and that one becomes the queen of the hive. And in case there are no queen cells started then they go to work and produce one from the egg, but we gain considerable time from having that queen cell already there. A good many bee keepers raise several queens and have them on hand ready for artificial swarming, and that is another advantage where a great yield of honey is to be obtained, and here I may say in regard to raising queens, if we want to raise a few surplus queens, it is always to a bee keeper an advantage to have a few surplus queens on hand throughout the season. We will take a little box, a minature hive; we'll have it about half as large as this; take a swarm and divide it up into as many little colonies as we choose, take the queen away from it, put about a quart of bees in each of these little boxes, give them eggs to start with and they will go to work then and produce a queen, and soon after these are hatched you will have queens to work with for artificial swarming. One hive will be a little smarter than the others, and that is the one to look out for and take your queen cells from. You can break up a swarm and put them into these little boxes and get from six to a dozen queen cells all capped over; cut them out with a pen-knife when

they are ten days old and they will hatch out a queen, adapt themselves to their little miniature hive, and they will go on and work as contentedly as can be. But when you take that queen away you must have it supplied with eggs; leave her there long enough to lay in order to supply it with eggs, so they will get along through the season.

MR. HAZARD. Do you think that black bees work better in sections than the native bees.

MR. SWEET. Well, yes; sometimes we think so, and then again we don't think so. There is a good deal in the management in getting them to work in sections, though some think they will work quicker in sections than the Italians, but they can be brought up very easily. I was at Mr. Doolittle's a few years ago and noted his method. He placed the boxes at the sides in the main part of the hive, and when the bees got them half or two-thirds full he raised them, put them on the top, bringing the bees right up with them. He had no difficulty in having them work in boxes. It is sometimes thought, I know, that the black bees will work more easily in sections than the others.

QUESTION. Do you think it just as well when they swarm artificially as when they swarm naturally?

MR. SWEET. Yes; I have proved it time and over again.

QUESTION. How many swarms can you get from one good, healthy swarm?

MR. SWEET. It is best to confine yourself to one swarm, though you can secure two by very careful management and get along all right; but one swarm is as much as it is safe to calculate upon, in this section of the country; when you count on making more you have got to resort to feeding generally.

MR. BAILEY. Where were the bees during the recent cold snap?

MR. SWEET. Snugly quartered in the centre of their hives. I have taken notice that when the thermometer was two degrees be-

low zero I have been to the hive and lifted off the top of the packing (we usually cover the top of the hive inside with five or six thicknesses of carpeting or sacking, something of that kind, over the bees to take up dampness and moisture arising from them) and I have placed a thermometer right in among the bees, and it went up to summer heat within a few minutes. Of course it would not do to leave the hive open many minutes, because they cannot stand a temperature of even forty degrees and live. They keep close in five combs almost in the form of a ball, and very thick just below the end and at each side of them, but they are closest at the very top, and the colder the weather the smaller the ball is that they press themselves into, and as the warm days come along they expand and fill the hive, and will make a much larger appearance than in a cold day. It is not safe to disturb them at all on a cold day because they have to keep close together to retain the animal heat.

Mr. Hazard. Suppose the hives were covered with snow?

Mr. Sweet. They seem to work very well,—the bee needs an abundance of pure air through the winter. I winter almost all of mine on their summer stands, a few only I winter indoors; three or four that may not have their hives full of comb, those I will take more pains to winter indoors.

Mr. Hazard. Don't clear the snow off at all, then?

Mr. Sweet. No, sir; unless it comes an icy time and binds it to the hive, but with a light snow, all covered up, they will get air enough to keep them in nice condition.

Mr. Bosworth. Do they want any shade along in April and May, in front of them?

Mr. Sweet. No, not at that time of the year, you want the full force of the sun.

Question. Will the apple tree make pretty good shade for the bee hive?

Mr. Sweet. It is well enough in hot days in summer to have them located where the direct rays of the sun will not affect them from ten o'clock to three, but on the whole I would rather have them stand in the sun, than altogether in the shade, they will do better; but we want to protect them most from the winds; cold, piercing winds are the worst things for them.

Mr. Bosworth. Don't you think that grape vines are better shade than apple trees?

Mr. Sweet. Grape vines are very good, but if you have a swarm in them it is a very difficult job to take them out.

Mr. Hazard. Sometimes they go away.

Mr. Sweet. Well, sometimes we have a late snow — quite a late snow. Some put boards in front of the hive to keep the snow off or keep them from flying off too quick. If they drop into the light snow they will not get up again all right. For instance, here one day this week we had a very warm day; every hive of my bees was flying as actively as if it was summer time, in the sun, on the fences and on the top of the hives, and they all got back to their hives again, except those that would die of old age, and those the bees would scatter out upon the snow; and on opening one hive I found the queen already laying at this time of the year.

Question. What effect does artificial feeding have on the health of a bee?

Mr. Sweet. That depends on what you feed to them. If you feed sugar syrup they will keep just as healthy as they will on the honey, but you must not use anything but the very best quality of what you use—no cheap sugar or molasses. Granulated sugar or coffee crust sugar you might feed to the bees with perfect safety.

Question. What effect does glucose have?

Mr. Sweet. It is dangerous stuff to work with on bees. I have known of a man nearly killing all his bees by the use of glucose. Sometimes in the process of manufacture sulphuric acid is used,

and if not thoroughly cleaned out it is death to the bees. A man in a section of Ohio, when his bees came short of honey in the fall, tried to carry them through on glucose. It was dangerous—he lost his bees. But all those that I know of that have tried pure sugar of the best quality have been successful with it.

MR. HAWES. What distance will bees travel in search of honey?

MR. SWEET. I have known them to go two miles or more, and bees will go, it is thought, six or seven miles; but it is to their disadvantage to go that distance—they may go over wide streams of water, their wings soon become worn out, and when they do they are useless.

MR. HAWES. Do keepers generally raise something in the way of clover to keep bees?

MR. SWEET. Well, it is desirable to. I have sown clover several years with good results.

MR. COLLINS. What kind of clover?

MR. SWEET. White clover—the Swedish clover; also I notice they gather from the red clover in some seasons considerable.

QUESTION. Second crop?

MR. SWEET. More particularly.

MR. BOSWORTH. What kind of bees work upon red clover?

MR. SWEET. Italian bees.

MR. GREENE. Will you explain the principle of the double-walled hive, and give your opinion of it?

MR. SWEET. In regard to the double-walled hive, it is a useful thing,—but it is going to a good deal of trouble, and the simpler we can get through our operations and winter our bees, that is the method we usually want to adopt; but with those hives you can keep a swarm of bees very warm, and they will not feel the changes of temperature so much as they will in the single-walled hive; but I have no difficulty. The frost will not accumulate so much in the double-walled hive, and they will have times when they will not consume as much honey.

Mr. Bosworth. What kills the bees generally in the winter?

Mr. Sweet. Well, changes in temperature has much to do with it—sudden drops in temperature. Then, again, there are a good many bees die of old age passing through the winter, and they will sometimes become diseased by the condition of the honey that is gathered in the fall. If it is a wet fall the honey is often-times watery, and it is in a certain half-fermented condition at times. If the weather is warm and wet, their winter stores will be unhealthy, and the bees will become unhealthy and a great many of them will die, and by spring we find our hive all gone; but when the fall is dry, we find the honey is of much better quality and the bees winter much better for it than when it is a wet season. That seems to account for a good deal of it. For instance, last fall was very dry, and I found every hive wintering in complete order—carried through so far, and I have no doubt but what they will go through the rest of the season.

Question. Do dry seasons produce the best quality of honey?

Mr. Sweet. Dry seasons produce the best quality of honey; and that is an important thing to know about, for when honey is gathered when it is wet, you will be apt to find it in a fermented condition, which spoils it. A good deal of honey has been sold in that condition, and bee keepers are beginning to learn now to sell well-ripened honey. It is greatly to their advantage, and if it is gathered in a dry time it is much heavier and better. It is an advantage to allow it to remain in the hive as long as possible, and then a great deal of the water is evaporated from it, and the aroma is improved. I defer extracting till August or the middle of September—almost till cold weather; then I finish extracting in order to have the honey well ripened and thick,—it is of much better quality and taste.

Question. Would you advise doing the same with box honey?

Mr. Sweet. Well, in regard to box honey, it has something else

with it, and it often pleases the eye and attracts a ready sale. It is of no advantage to the honey, really, but the honey, if left in the hive, in the comb gradually assumes a yellowish appearance, and that tends to injure the sale of it; but the quality of the honey is much better. That taken off just as soon as the bee has filled it looks the best. If it is a dry time when it is gathered, it is advisable to do so by all means.

QUESTION. If the public could be educated to take it dark, would it not be much better for all concerned?

MR. SWEET. Yes, unless it should be made from a dark flower bloom. Now, I will explain the difference in the color of honey. White clover makes white, nice honey. The color of the bloom influences the color of the honey. In a section where the black huckleberry grows thick, for instance, a dark honey will be made; but the swamp huckleberry produces a white bloom about equal to clover, and makes a nice honey. Sometimes you will be deceived in the color of honey in that way.

QUESTION. Will the capping of dark honey be white?

MR. SWEET. No, sir.

QUESTION. Dark flowers would influence the color of the comb the same as the honey, would it not?

MR. SWEET. Yes; the whiter the flower, the nicer and whiter the color of the comb and the honey will be.

MR. GREENE. Does it make any difference about the kind of bee that puts up the honey—whether it is dark or light comb?

MR. SWEET. Well, I don't think it does, unless the Italians are gathering from red clover—the honey will have a certain pink cast, but it will be very rich and very nice honey; whereas, if black bees are gathering from white flowers, their honey will be whiter, and consequently it will have a different appearance from the other.

QUESTION. Do the bees gather much honey from the white mulberry?

Mr. Sweet. I have not had experience with that so as to know.

Mr. Hazard. How is the raspberry?

Mr. Sweet. Most excellent—one of the best plants we have for honey. Bees will gather honey on rainy days almost, some say, from them. The bloom is pendant, and the bees can work on the under side of them; and if a shower comes up it doesn't wash the honey out as it does from an upright flower. You will find bees working on the raspberry bloom when you won't find them on anything else.

Mr. Greene. Is the locust tree good?

Mr. Sweet. The locust tree produces a good deal of honey.

Mr. Hawes. How are cherries?

Mr. Sweet. Cherries make a very nice-colored honey—and then I will note another fact. Whenever you see a tree in full bloom, and notice it is full of bees—fairly alive with them—you may look out for a good crop from that tree; but if you see one all covered with bloom, and no bees, you will not find a very good crop.

Question. That is because the bees fertilize the flower, is it not?

Mr. Sweet. The honey seems to have been made for the bee, and the bee for the honey and the flower.

Question. From your experience in the manipulation of hives, what kind do you give the preference to?

Mr. Sweet. Well, it doesn't make so much difference what kind of hive you use; it is more in the management. The Langstroth hive rather leads; I have known it ten or fifteen years. I have also used the Modest and the American. I have experimented largely to find out which is the best. I am a person that is not prejudiced against the use of any of these things, and I want to test and try the different ones and find out which is good; and will use it, no matter what it is. In regard to the kind of frame or hive used,—at this time there seems to be a good deal of contro-

versy about the reversible frame that bee keepers are much concerned about; but it is something to be tested still further, I think.

QUESTION. What has been your experience in getting a surplus from apple blossoms?

MR. SWEET. Very good. When we have an abundant yield of apple blossoms we generally get a large yield of honey.

QUESTION. Extracted or box honey?

MR. SWEET. Well, you can get both, but more extracted than you can boxed honey. It is a very important time to have your combs on hand ready made like these; you will get twice and three times the amount than if you put on empty boxes like these and wait for them to build it.

MR. MACRAE. Would you advise extracting honey before it is sealed over.

MR. SWEET. No, sir; I would not. I have seen it done, to the injury of honey almost always. The only time when you can do that is when it has been gathered after a dry spell. If we have had three or four weeks of dry weather you can extract it without it being sealed over, but a good deal of care and judgment must be used about it.

MR. HAWES. Would the bloom of sweet apple tree make a better honey than the bloom of sour?

MR. SWEET. Well, I have not observed any particular difference in that respect. I do not presume it would.

MR. W. H. HOPKINS. From your remarks I judge that it would be well for every tree grower to have at least one or two hives of bees in his yard or orchard.

MR. SWEET. Yes; I have had gardeners apply to me for bees just to fertilize their nectarines and other kinds of fruit—peaches, for instance. They get a more perfect fruit.

QUESTION. I would like to inquire if they are not injurious to some kinds of fruit—peaches and pears, for instance.

Mr. Sweet. Well, in regard to that, the injury is most always done by wasps—but it is done by the bees. The jaws of the wasp or hornet are much stronger than the honey bee or yellow wasp, and you will find them on the grapes or peaches generally first; but the moment the peaches or the grapes are broken, the bee is on hand to help also. I have known grapes just before they were ripened to have wet weather come and crack the grapes,—then the bees come and help themselves, and the grapes go very fast; but yet the grapes would be in an unsaleable condition, even if marketed very quick.

Mr. Bosworth. Don't you think the pears they would work on would be unsaleable before they commence to work on them?

Mr. Sweet. Yes; over-ripe.

Question. Have you any knowlege, from your experience in this business, of the bees extracting poison, by which anybody can be injured by eating the honey?

Mr. Sweet. I have never known of any person being poisoned by honey. I have heard of it in southern states, but I have never known of it here in New England. I have repeatedly watched for it among all kinds of flowers, have eaten honey myself gathered from all kinds of flowers, but I have never known of anyone being poisoned.

Mr. Hazard. Buckwheat makes very dark honey, does it not?

Mr. Sweet. Yes. I should not advise anyone to sow buckwheat. It makes a very dark honey, and a honey of a peculiar flavor, not liked by many. They use it in sections of New York state considerably, where a great deal of buckwheat is raised, and a good deal of honey from buckwheat. Some people like it, so there is considerable of it used there—more than anywhere else; but you bring it here to our eastern markets and it is hard work to sell it. It has a dark color and a peculiar odor. At one time I sowed a field with buckwheat—I thought it might help out in the

fall for the bees' winter stores; but when the buckwheat blossomed it blossomed very full. There was but a very few bees that went on to it—they were flying over the field back and forth; and I found, when it came time to harvest it, that there was not enough to pay for harvesting.

QUESTION. Is there any trouble in moving the bees from one place to another? Do the bees find their way back to the hives?

MR. SWEET. In the summer time, but not in the late fall or early spring. It is rather a dangerous practice to move a hive from one part of the yard to another except in the winter time—warm days in winter. It is said, "A bee convinced against its will is of the same opinion still." So you have got to move them half a mile in order to have them accept their new location.

QUESTION. Is it safe to move them in the winter?

MR. SWEET. If the weather is cold, it is not safe; but if we have had two or three warm days you can move them; but it is not safe to move them while there is any frost in or about the hive because you create a good deal of excitement, and a great many get chilled,—it seems to be very bad. I have known of hives being ruined by moving them in the dead of winter. March or April is a very good time—also November. You may move them in the hottest days of summer also. The past season I had occasion to send bees to New York State. I sent the bees up the Hudson one day when the thermometer ranged at 90° along through the middle of the day. They were sent by boat at night, and consequently they went through all right. And I sent a swarm at one time to Messrs. Thurber, of New York. I sent them at the close of a very hot day, and they arrived in perfect order; but it has to be done very carefully. You have to give the bees an abundance of ventilation in order to accomplish it.

DR. WIGGIN. We are very glad of the freedom shown in asking questions in regard to the subject of bee keeping. I suppose it

will be necessary to bring our exercises to a close. We are here as members of the R. I. Bee Keepers's Society at the courtesy of the Society for the Encouragement of Domestic Industry, and we do not wish to encroach too much upon their time. We would wish to extend to Mr. Sweet the thanks of the Society for the interesting address of to-day, and solicit membership to the R. I. Bee Keepers' Society.

FIFTH LECTURE.

Feb. 18, 1886, lecture by Hon. J. J. H. Gregory, entitled "Commercial Fertilizers as compared with Barn-yard Manures."

The meeting was opened by Secretary Smith, who announced the next meeting was to be a report of experiments at the State farm with fertilizers, and then introduced Hon. John F. Chace, of Portsmouth, Vice-President of the Aquidneck Agricultural Society, who presided. Mr. Chace announced the speaker for the afternoon, Hon. J. J. H. Gregory.

MR. GREGORY'S ADDRESS.

MR. PRESIDENT: What is a fertilizer? In the general sense, all plant food. I have used fertilizers very largely myself, and a man has to prove his faith by his works. I have used fertilizers for twenty-five years, and have become more and more dependent upon them for success in my farming. I am a seed-raiser, but I have first to be a farmer, raising my seed stock. I have of late years grown all my onions off fertilizers—14 acres, and last year 20 acres of corn wholly on fertilizers. For beans and tomatoes, also, I use fertilizers. I used last year 130 tons, including fish fertilizers; so from this you may infer I have a practical interest in the subject. What is plant food? You learn what plant food is just as you learn what any article of merchandise is—we analyze the product of it. We analyze plants; they are taken apart chemically, and we find out what they are made of. Could any of us know intelligently what to feed to them if we did not know what they were made up of? Plant food, we find, is made

up of about ten different substances. Most of these exist in sufficient proportions in all our soils,—therefore we needn't discuss them; but phosphoric acid, nitrogen and potash are the three principal elements which all our soils need to perfect vegetation, and the food we give our plants must have these three elements. Occasionally we find soil that from the liberal manuring nature has given it, can sustain growth year after year without them, but the original stock is decreasing every year. There is no miracle—there is no eternity in the capacity of any soil; and there comes a time when the decrease is shown in the crops, and then we have got to add more or less of these three elements—usually all.

Where does it come from? The great natural store-house of plant food—mineral food—phosphoric acid and potash,—are the rocks of which granite is a type, From their decomposition the soil acquires the mineral portion of the food which plants take from it. We therefore get from rocks, from the original storehouse, our mineral proportion of plant food. Now, then, can we keep up the fertility of the soil in this manner without the aid of fertilizers? As I said before, every crop decreases the natural capacity of the soil. Can we in our farming system, without the aid of fertilizers, keep up the fertility? We know that every pound of grain that goes across the Atlantic takes with it phosphoric acid and other of these elements of plant food; every pound of beef that goes across carries out of the country a certain amount of plant food. Now, how can that be replenished? There is no miracle about it,—it is a mathematical matter. You take so much away; how shall we get it back again? If we talk about barnyard manure, that does not cover it; that covers what has not been taken away. What has been taken away must come from something outside of the original resources, and for this reason to keep up the fertility we must come down to fertilizers. We have got to seek plant food outside the resources of the country—of the natural resources, I mean. I say natural resources,—I mean resources such as farmers handle, as turning down green crops, which do not add to the fertility except in the matter of nitrogen. Some say many crops do not need

the aid of fertilizers. Clover and some others collect it from the air, and in turning these under you really add nitrogen in the soil. But the phosphoric acid and potash that are in these plants—clover and beans—are what they have taken from the soil, and by turning them under are merely put back again, and do not increase the stock of plant food except nitrogen. If we feed our crops from the farm and ship nothing from them, of course the farm is kept up; but if we sell we have got to replenish from outside sources.

There is another source of waste besides this shipment of corn and flesh—and that is sewage. There is a great cry made nowadays about the waste that goes into the ocean and rivers, and the economy of saving it is talked of; but it is well established that up to this date there is no practical economical way by which the waste of cities can be saved. They are saved, but it does not pay—the outlay is greater than the returns made. If you notice the report that was made by the Boston committee on an enlarged system of sewerage, you see that they state that there is no process known by which the waste could be economically saved. Now, I am greatly inclined to think there is no waste. Where does this sewage go? Into the rivers and then into the ocean.

I dwell on this sewage question, for it appears to me in a little different light. By what means do the ocean plants—the submarine algæ, rock-weed, and so on—grow? There is no miracle about that. They grow from what they take out of the ocean. Where or how do they get their food? It comes from the land. The same source that furnishes plant food furnishes ocean food. It is taken in solution by the water and carried down to the ocean. Along the shore you will find all this vegetation. And this is that comes up on our shores after a storm, and is used largely in manuring, contains precisely the same elements that your barn-yard manure has, for their growth is fed in the same way. From the waste of the rocks marine plants get their food, and our hillsides covered with rich vegetation obtain their food in the same way,—are fed from the same source. Now stick a pin in there. You let your sewage run into the ocean—What becomes of it? It is dis-

solved in the ocean water over hundreds of thousands of square miles by the motion of the water, and it feeds these submarine plants. There is no waste to it. Every particle of sewage becomes ocean food. Near the cities it is so strong that it kills, and there is less growth than the average; farther off it increases their growth. Using large quantities of rock-weed—one or two hundred cords every year, and I always have a chat with the sailors on the shore. They tell me that where there is a bold shore, a sea continually rising and falling, rock-weed grows a great deal faster than along shallow shores, attaining a growth every year of about the length of a common grass crop. The motion of the water gives it continually new food, and it therefore grows more. I say that this anxiety about sewage waste has no real foundation. It promotes ocean growth, and from the waste of that we get its return.

We act in a sort of haphazard way about using this ocean growth,—we wait for a chance storm, and then pick it up. We do not do this in land matters. We sow, we reap and gather in. We can reap and gather it with some system in this. You know when the United States vessels dragged along the coast to collect submarine faunæ they had chains, and they brought up almost everything. Now I will stand here and prophesy that the time is coming when we shall reap this submarine growth as anything else. We have got to study winds and tides to do it in connection with natural laws, so that dredging steamers will go off and bring in harvest from these immense beds, and we will give it to our crops.

What are our resources for fertilizers? Where shall we get our potash, our nitrogen, our phosphoric acid over and above what our common farming supplies us? We can seize through the air by certain crops a certain amount of nitrogen. There is a boundless extent of it in the air, and enough for all our plants if we could only get at it. But no plant obtains it directly from the air. Clover and all the large plants get more or less. No one knows just how they get it, but we all know they do get some. Professor Atwater, in inaugurating a series of experiments in all the country, getting farmers all over the United States to experiment with manures, started with the theory that plants need

just what they are made of, but it was on the theory that it had got to be given to them directly. It was found that corn had the power to get a good deal more nitrogen than was fed to it, but while it did not need as much nitrogen as the crop contained, the phosphoric acid and potash it did need.

A large artificial reservoir for nitrogen is the gas works, where we obtain it in the form of sulphate of ammonia. It largely comes from gas liquor. Another resource is the great soda deposits in Chili—some think that these were once guano covered islands in an ancient ocean, which in the course of time became decomposed, leaving vast beds of nitrate of soda. We find also in Hindostan vast deposits of saltpetre. Phosphate makers all through the North depend largely on the fish waste from the ocean for the nitrogen which they put into phosphates, so-called. These and animal waste, especially blood, are our great resources for nitrogen.

Now, what are our resources for phosphoric acid? Apatite, which is a mineral, is almost pure phosphoric acid. That is found in vast quantities in the North. It is a very difficult mineral to work. There are great beds of phosphate rock in South Carolina and Georgia—extending over hundreds of square miles. You may say it is inexhaustible. These rocks were just as much of a nuisance as our rocks here, and were carted out as such until (by chance, you may say, I call it Providence) they were found by a chemist to be rich in this wonderful necessary mineral.

Lastly comes potash. While we were fast losing our primeval forests—the original source of potash—our tillage land was enlarging, and the question rose, through Europe and America, where would we get our potash? Just about this time the great beds of northern Germany were discovered, which are probably the deposit of an ancient ocean, and are almost unmeasurable in extent. They were tapped for salt, and in getting the salt large areas were found of something which was not salt and thrown aside as useless. When the chemist touched it with his wand it was found to be potash almost endless in extent. Our own country is the grandest in the world. There is no country

like it. Now, how came this nation to be located in a country which has the grandest resources of any on this earth? Why, the two things go together—there is a design in it. God designed this nation to be the greatest of nations. To give a single illustration, we have the greatest quantity of phosphates and of potash in the world. We have in one or two of our lakes not yet tapped, in California and Oregon, twenty-three million tons of potash. This is only so much found. In the Great Salt lake and in California lakes there are millions more tons. I might go on in this strain and speak also of the coal formations, the gold, silver, lead and copper. No country in the world has such immense deposits. And I speak of God's hand in this and believe it reverently. How was it that phosphate deposit came to be discovered? What could we have done without it? A nation of seven millions set free to become farmers—what could they have done without these phosphates?

The time was when farmers in the South planted acres year after year until they exhausted them—then took other acres and exhausted *them;* but the poor black, with his three or four acres—how could he have lived? But about the time he was made free the phosphate beds were discovered—the same about those deposits in Germany; when the world was puzzled to know where potash was coming from they were discovered. You know when kerosene came in whale oil was getting low—the whales had gone into the Arctic. I do not believe in chance of happening—there is no chance.

You find farmers who say they put leached ashes on their land at 16 cents a bushel, and had just as good a crop as the man who put on unleached at 30 cents a bushel; and they say they don't believe unleached ashes are worth a cent more than the leached. Yes, they are! The more potash you have the more value you have. It may not appear in your crop. To be sure, the unleached seemed no better in your experiment, but that merely showed that in your land the potash was not needed. You might just as well have used unleached ashes—you have merely wasted your money so far as that crop is concerned. But bye-and-bye you come to some part of your land that wants potash, and then you will find just the difference in value between leached and unleached that there is in the market.

Now, is it waste to use fertilizers? What means have we for enriching our land? You farmers have your barn-yard manure; then you have your special barn-yard manure. I mean to say, you go to work and feed stock to make the right sort of manure for your crops; but barn-yard manure usually means everything and anything. There is no phrase used that can mean so much. We feed meal to our cattle, but meal is not the only thing. We can give concentrated foods, cotton-seed, linseed and such foods, and thus you can make your manure very rich indeed in phosphoric acid and ammonia. Our farming cannot be highly successful until we are more intelligent in our feeding—until we study the effect of the food on the manure just as much as the effect on the article we are going to sell. For if your manure is not what it should be, it is going to affect your farm in the long run; so your success is going to turn on your manuring. There is as much in the quality as in the quantity, and so intelligent farming requires us to be as careful in feeding our animals of the effect upon the quality of the manure made as on the direct product—milk or cheese. Brother farmers, bear this fact in mind: most of the important plant elements in the food goes into the mannre. Butter takes no plant food from the farm. The milk gets a good deal of phosphate, to be sure; but if the animal is a full-grown animal, it gets very little indeed of potash, phosphorus and ammonia—it gets carbonaceous matter. But a very small portion of the plant elements goes into the cow—the greater part goes into the manure heap, and that is the reason why you should have reference to that when selecting her food.

A gentleman came to me in the cars to-day and said: What do you think of using cotton-seed for manure? I said: Very good, indeed. You can use it for manure directly; or you can feed it to your animals and get just about as rich plant food, for it is about all carried into the manure. I buy it spoilt sometimes for half-price, but even then I question whether I make any more than if I bought it good and fed it. I would as soon buy it at full price and feed it, get the milk, etc., out of it, and let it go into the manure. Now, I said you have your common manure—your barn-yard manure, and your special manure made

by feeding rich foods ; but that will not cover all your want You cannot have what you need by turning under green crops ; you gain no potash or phosphoric acid—although some nitrogen. Therefore, you have got to come down to fertilizers to make up the loss from what you sell. Now, if a farmer does not sell anything, or if he sells only milk or butter, his farm is as good as before. If he sells milk he has got to resort to phosphates. We put on manures with reference to what is taken off our farms. The Germans have a regular debit and credit account. They analyze their soils to find out what they need by experiment, and by this debit and credit account put such and such elements into it in the way of manure. In such a crop are certain elements that are taken out of the soil ; they will put that down. Then they return them into the soil again—so much phosphoric acid, nitrogen and potash. They charge that to the field ; then when their crop comes off they know just how much phosphoric acid, how much nitrogen and how much potash comes off in the crop ; and so they proceed every year. That is the only way to do—have a regular bank account with our fields.

Now, let me raise a question, Is there any difference between plant food in fertilizers and barn-yard manure? I know it is raised in the minds of a good many of us. We think fertilizers do to stimulate, or temporarily ; "but, after all," say many farmers, "give us good barn-yard manure. There is some reason in that ; but is there any difference —any fundamental difference—between the food the fertilizers furnish and barn-yard manure? *There is none ; there is none.* Phosphoric acid, potash and nitrogen are in fertilizers and in barn-yard manure. The only advantage of fertilizers is that they are all ready for the plant to take up as food. In fifteen tons of fresh barn-yard manure, how much ammonia do you suppose was ready? Just one pound. That is all that was ready out of the fifteen tons by careful analysis. At the same time there was 140 pounds in it, but in the undeveloped state. All the food that corn needs to give you 60 or 70 bushels to the acre is what it can find in 2½ cords of barn-yard manure. All the potash, all the phosphoric acid and all nitrogen actually exist in about 2½ cords of barn-yard manure.

Yet, you cannot raise 60 or 70 bushels of shell corn with any such feeding as that. You want at least 6 cords to the acre to be sure of about 60 bushels of shell corn. The reason is that the plant food there does not all become available at the time the crop is growing. But with fertilizers the food is about ready for the plant. It has been found by analysis that the quantity of plant food required for the acre of corn is—nitrogen, $81\frac{9}{10}$; phosphoric acid, $44\frac{8}{10}$; potash, $53\frac{4}{10}$. Now, then, this certain amount, as I said before, you will find in $2\frac{1}{2}$ cords of barn-yard manure—which contains $\frac{1}{2}$ per cent. of nitrogen, $\frac{1}{2}$ per cent. of phosphoric acid, and a little less than $\frac{1}{2}$ per cent. of potash. You will haveto get 200 pounds of manure to get one pound of phosphoric acid, or over that to get a pound of potash, for 70 per cent. is water, 10 per cent. silica or sand. Now if you should pay 20 cents a pound for your ammonia, it would come to about $16; 6 cents for phosphoric acid, $2.50; $3\frac{1}{3}$ cents for potash in the form of a muriate, $2.25—that is a little over $20. Even with this high valuation of ammonia you can raise a crop of corn at a far less figure than you can raise it with barn-yard manure. To get that crop you would want at least six cords of barn-yard manure; but six cords of barn-yard manure brought on the land, including teaming, transporting and handling, cannot be less than $8 a cord, which would give us somewhere towards $48,—we will put it $40. You have to put on just twice as much value in barn-yard manure on your crop as you would fertilizers, and this is not all, for nitrogen is put at the price of $20\frac{1}{2}$ cents a pound; when farmers can buy it much cheaper than that by going ahead and picking up material, especially fish waste. I suppose you can get it for about one-third or one-fourth the price in this way. I go down to Gloucester and buy cords of it—halibut chum, fish skins. The former is pressed into barrels.

Now, some of you will say this is a very pretty theory, but how about the practice? Well, we have got the practice right on top of it. The Connecticut experiments that were tested all over the country demonstrated this fact. In over 53 cases they found the average cost of raising over 50 bushels of corn to the acre was inside of $8. That is an actual fact—no theory about it, they used 150 pounds of muriate of

potash at $3\frac{1}{3}$ cents a pound, the rest was fish guano, and the average cost was $8, or inside it, for raising an acre of corn. So you see the thing has been practically done. For several years I have raised my corn on fertilizers, and had 80 odd bushels to the acre.

One thing more about this matter of nitrogen, friends. An excess of it will make an excess of stalk and deficiency of grain. Where we get it cheap we sometimes over-manure with it, but it costs us too much in the end—we get a great crop of stalks and a small crop of corn. One of my neighbors put a great quantity on his land. He was passing one day and thought he saw the land move with a sort of wave motion—very gentle; and in fact the land was so richly manured it was alive with maggots—actually enough to keep the land moving! You never saw such tall vigorous corn, but there wasn't an ear, it was all stalk. The next year he had the greatest crop he ever had—the manure had worked down through the soil, and there was just enough potash, phosphoric acid and ammonia to carry the thing along. You can never waste potash or phosphoric acid. If you over-manure your land with ashes, it never goes down, never wastes,—the same with phosphoric acid. Therefore, what you get in excess in one crop, other crops will always find. Nitrogen, on the other hand, is a vanishing element—it goes down and you never hear any more of it. That accounts for the phenomena we now and then find in digging down to hard-pan in digging wells. We sometimes see the greatest growth from that soil. I have seen mustard—the common mustard plant—with the leaves as big as cabbages growing on the gravel waste. That shows that the ammonia had gone below the reach of common plants and was brought up with the soil dug.

One word more about the contest between manures and fertilizers. If you think about it you will perceive that Mr. Darling might make his fertilizer from barn-yard manure. The only thing is, it takes more material. He takes animals—remains of dead animals—obtaining from them ammonia, phosphoric acid and potash, mostly phosphoric acid and ammonia. Now, nothing hinders from taking the manure itself and giving you just the same elements from the manure as he gives you by taking

animals. Look at that a moment so as to set your minds right; is it not reasonable that it should be so? You feed an animal with a certain quantity of hay—what becomes of it? Part of it passes into the animal, part of it passes out from the animal in the manure. Then, if you just take what elements there are in the manure and add just what is in the animal, you will have the elements that were in the original hay; also, take what is in the manure and subtract what is in the animal, and you will have just the difference. The two together will always make up just what is in the hay.

Now, is there no difference between barn-yard manure and fertilizer? There is not in the elements that enter into them; it is in the mechanical condition. In manure there is greater bulk and very little richness. That greater bulk has value in that it goes mechanically into the soil and lightens it, and enables the roots to push more easily and find the food. Your elements, so far as food goes, are just the same precisely in your manure as in your animal. Now, having conceded this distinction between them, what are the advantages of fertilizers over barn-yard manure? Comparing them on their merits, I will tell you that if I was a farmer raising milk and grass, I should not use fertilizers as I do now. Why not? Because I should get my manure mostly from the food, feeding my animals with such food as to enrich the manure and still have the advantage in the food—very little of the fertilizing elements going into the milk of the animal. I have this advantage, also, when I come to lay my land down, in the phosphoric acid and potash that is not ready for the first crop the after crop will find and feed on it.

Now, I want to distinguish on that very account between fertilizer and barn-yard manure. Suppose we take a corn crop—what is the use of fertilizers if this extra remains in the soil—if the first crop does not take it up, the other crops will find it, and there is no loss? I will tell you. In market gardening we manure only for the crop we plant each year. There is no one that pays respect to what is left in the soil from the last year's manuring,—he makes some little allowance, but it is not enough to depend much upon it. Now suppose we take a piece of ground—on one half we use fertilizer, on the other barn-yard manure; we will

run it ten years. We will put on this six cords of manure costing $8 a cord—that is $48, or $480 for ten years; the other piece of land we will put on fertilizer costing perhaps $15—that is $150. Well, now, here I stand at the end of the ten years—what is the result? We'll pick up what is left in the ground. We know that the fertilizer always leaves something behind it, and we will suppose you get enough extra crop of grass to count one ton for two years, and on the piece that has got barn-yard manure you get a ton extra for eight years. At $20 per ton that is $160 in favor of the piece that had manure on it, and $40 in favor of the piece that had fertilizer on it. Now, $160–$40 leaves $120, what is left on account of using manure. But look at the fertilizer: we had $480 worth of barn-yard manure and we had $150 worth of the fertilizer; $480–$150=$330. Now, you see in the case of the manure the fertilizer piece is $330 ahead, and in case of the after-crop of grass the barn-yard piece is $120 ahead; $330–$120 gives you gain from your fertilizer of $210. That is from one acre of land in each case.

Now, then, about these fertilizers. If I was a farmer—and I am,—I have got a large lot of barn-yard manure, and, of course, I must use it, indeed, I buy hundreds of cords every year for the various crops I want it for. Well, suppose I am going to raise corn,—it appears to me no Yankee can be a Yankee if he has no corn crop going—that is our loyal crop,—there is nothing so grand in the crop kind as a field of Indian corn. Therefore, we will pick out our lightest land and give it fertilizer enough. That light land with fertilizer can raise corn for fifty or a hundred years. Here is one limitation: you find bye-and-bye your land bakes. The trouble is, it wants humus. This is black earth—it isn't manure itself—it merely has the power of absorbing food in the soil and giving it up when the plants want it; it is a holder of manure elements. You are not dependent on barn-yard manure for humus; anything that will give you a larger growth gives the humus. Raise rye and plough it under and it will give you an immense body of humus. Or take muck and make a compost,—cord for cord it has three times as much humus as barn-yard manure. When your land gets hard and bakes put your muck into the compost and plough it under, and that

gives humus. You see, therefore, that the objection against using fertilizers is overcome by getting humus from the outside source. Your fertilizer will grow your rye—rye ploughed under makes good humus.

Now, about hen manure. That comes under a sort of half-fertilizer. A great deal of talk is made about it. There is nothing more ridiculous than the extra value given hen manure. There are the most absurd statements made about the mystery of it. One man ranks it as equal in value to Peruvian guano, and speaks about saving from fifty hens manure enough to raise six acres of corn. There is great difference between guano and hen manure. Guano is manure made from birds fed on fishes and laying for untold ages. From a great quantity there is almost nothing left—it is so concentrated; and the talk made about home-made guano being better is most absurd—it is almost absurd to try them; I did so. The great deception about hen manure is that it stimulates—it starts things at once; but if using manure from fifty hens you get a crop of corn from six acres, it comes from the land, from what has been left over from former crops. Hen manure has not given that. Why, it is all as plain as black and white—it hasn't got the elements in it; it can't give what it hasn't got. As soon as you analyze it you see it can't; it hasn't got any such abundance of the elements which enter into the corn crop. How do we determine that? We analyze the manure and analyze the food. There can be no element in the manure that is not first in the food—all as plain as A, B, C. It has got to be in the food first whatever it is—nitrogen, phosphoric acid, potash. Those of us who have kept hens know they eat about two cents' worth a week—about two bushels of corn a year. If fed only on corn we know the hen can get no more nitrogen, phosphoric acid and potash than is in that corn. What little food she has other than that goes with it. Bear in mind this also, that the droppings from the hen are not half of them saved. Now, then, here is another thing. The hen lays eggs and sheds feathers and performs her natural functions. People say you don't figure on what she gets from eating insects. The eggs take up a vast amount of nitrogen: so that, putting these things together, we figure hen manure when it is all dried at about sixty cents a barrel in

value—twenty or twenty-five cents a bushel. No man can get more than that from it, because it isn't there.

I think we farmers do not appreciate our profession half enough. I entered farming life when it was a rare thing for college graduates to go to farming. I have never regretted it. I find it is all I want to do to handle the problems of farming life, the manure question surely; and I think we make a mistake in making a dollar and cent measure of our farming success—altogether a mistake there. We have got to get money to live on, of course; but men generally get along better by reducing their luxuries than by increasing their incomes. But if we get what is necessary why should we be so anxious on the money question? A man says to me, "I raise 100 acres of potatoes, 30 acres of cabbages, and so on, and I get the money back from them; but I can't afford to buy pianos and have a couple of horses and teams to ride around with after all." I told him this, as I say to you—success in farming is measured by no such measure as that. Success of every man is measured by what sort of a family he turns out on the world—what sort of a family he gives to society to hand down blessings to untold generations. Farming gives greater blessings in that line than any calling whatever. Go into your cities and find who are the men that lead there. Who are the head men that are taken up to be senators and governors? They are the sons of farmers. Because you endowed them with money? Not at all; you have endowed them with something better than money,—healthy minds and bodies, economical and industrious habits, independence and purity of life—the greatest things in the world; money cannot buy them. That is the magnificent wealth given you by the farmer's life. You are only one removed from the Creator. You absorb from your contact with these magnificent things that of which the least measure is the money return.

Mr. Mowry. I have been very much interested in the gentleman's lecture, and in general I would endorse what he said; but, of course, we notice that he has fortified himself pretty generally from statistics rather than from his own practical experience. I

supposed he would give us a little more of his practical experience in dealing with these fertilizers, but he has illustrated by the Connecticut experiment station how much we could raise corn for on fertilizers by the acre, and so on. We always admire a theory, and he has given us a very good one; but, as I say, so far he has fortified it by the experiment station. But when he comes to compare, for instance, in his experiments, barn-yard manure with the fertilizer, — I have been making inquiry among my neighbors — (I never used much of the various kinds of fertilizers, but I have been trying to find out how much I could get for a certain amount, and he lays it down at $15 worth to an acre, but it seems to me that is rather lower than we ordinarily find it in the market; and for us near the city $8 a cord for manure is rather high,)—and I find by actual experiment that the farmers who are in the habit of using fertilizers use more than $15 worth, and some often go as high as $40. I know one of my neighbors raised a very good crop of corn the past season near where his cattle stood in the pasture, and he raised 80 bushels of shell corn to the acre with $24 worth of Stockbridge manure. Now, I want to ask the gentleman one question,—he was speaking of hen manure and I agree with him precisely,—but I want to ask him if something was left in the ground the second year—any considerable amount?

Mr. Gregory. I don't know. I am one of those that raise a crop year after year and don't figure much on what is left. I should not think it would be much—something like the fertilizer. The gentleman has referred to my quoting the experiment station. I did it because it refers to a great many experiments; my own are in the same line. I raise onions on fertilizers, and I give it at the rate of 5 parts of ammonia, 9 parts of potash and 5 parts of phosphoric acid. My fertilizers for onions costs me $28 per acre. I spoke of the corn crops because this whole thing turns on what your crops want. Analyze your crop—proportion your food

accordingly. Different crops want different amounts, and different kinds for the same crop. Take, for instance, cabbage. A man that goes to work to undertake to raise cabbage averaging thirty pounds apiece to the acre would have to put on a corresponding amount of food. He would have to put on an immense quantity of manure—fifteen or twenty cords. You see it varies with the crops. Cabbage is exceptional, I allow. Now, my neighbor, for example, took a piece of pasture land and took Stockbridge's manure—he told me he had four bags—(I don't know how much a bag weighs—200 lbs., I think—$16 worth)—and he got 90 bushels of shell corn, and the land had never been broken up before; and my neighbors raise their cabbages and onions wholly on fertilizer. Side by side with it they use barn-yard manure, and they generally succeed better with fertilizer. A man had a field on half of which he used fertilizer, on the other half barn-yard manure. He took a man on the field and said, Tell me which part was done by barn-yard manure and which by fertilizer, if you can? and he put his hand on the wrong side; he thought it must be barn-yard manure because he was in favor of barn-yard manure. There are always exceptions, of course, to the general principle, in this as well as in anything else. I will say with beans I succeeded admirably by giving them very little nitrogen, as they have the power to collect it; and the same with peas. I give them a large amount of phosphoric acid. It costs an acre of beans about $9 or $10, and for every crop of peas about the same. Tomatoes and cucumbers I grow on fertilizers, and I have crops at a very low figure, and raise them vastly cheaper than I could with barn-yard manure, as I live in the vicinity where there is a great deal of waste. Some years I have used great quantities of glue-waste and rock-weed (150 cords) and night soil.

SENATOR OLNEY. Do you manufacture your own fertilizer?

MR. GREGORY. Yes; that is a point, too. I do not discuss this

phosphate or that phosphate, because phosphates vary. If you are going to feed a plant you want to feed just what it wants; therefore go and buy your different elements and compound your own. There are first-rate fertilizers here. There is none better than Darling's in the world—honest made all the way through, and you can buy Darling's and feed it for what it is worth — have it analyzed; and whenever you have your crop you have in it so much ammonia, phosphoric acid and potash. I buy what is called phosphate made of dead animals. I depend on that mostly for my phosphates, though I use some Carolina rock, and I add to it what I want for the different crops—ammonia and potash. We shall never get through this till we aim to make our own fertilizer, then we shall adapt it to the ground, and the fertilizer will turn into dollars in raw materials. That is where we want to put them.

MR. HAZARD. Suppose it is a very dry season, will the fertilizer work as well as stable manure?

MR. GREGORY. I have got to come to that experiment station again. Now, Prof. Atwater has made all these experiments and compiled them, and you will find somewhere in his reports that the result is this, that in extremely wet or dry seasons the fertilizer came out inside of the barn-yard manure on an average. I had an impression that the dry season would go harder with the fertilizer than the barn-yard manure; but you will find somewhere in his reports that in the 150 experiments the fertilizer came out ahead on the average in the excessively wet and excessively dry seasons.

MR. MOWRY. You are, I believe, from Marblehead?

MR. GREGORY. These farms I spoke of are at Middletown.

MR. MOWRY. You spoke with regard to light soils for corn.

MR. GREGORY. Yes, I have used them for corn.

MR. MOWRY. I do not find that any of my neighbors can, by using a considerably larger quantity than $18 or $20 worth of fer-

tilizer, raise 60 or 70 bushels of corn even if they use a good quantity of barn-yard manure. It is hardly a fair crop to come up to 60 or 70 bushels; they generally go under that. I was talking with a man not long ago, and he had a good crop of corn, as he called it, and he put on a good quantity of barn-yard manure on good soil and then fertilizer. He said he got about 50 bushels of corn to the acre—shell corn. I do not find scarcely any of our Rhode Island farmers that can get—with an expenditure of $18, $20 or $25—sixty or seventy bushels of corn to the acre.

MR. GREGORY. There comes in another matter,—you have got to have your soil as well as your manure. The season influences it just as much as the fertilizer, but the trouble there is probably that your soil is not adapted to corn. Some of your soil round here is magnificent for cabbages and potatoes. Corn abhors cold soil, and for that reason the manure ought always to be on the surface. The soil must be light. Melons and squashes seem to be the same. I should say that was the trouble in the soil. I have no trouble in getting different crops of corn on my land. What I have referred to is the three farms in Middletown.

MR. LOUIS WINSOR. How do you apply your fertilizer to your corn crop most successfully?

MR. GREGORY. About two-thirds broadcast and one-third in the drill; then I plant three-fifths of it in the drill and broadcast, and make two applications, one when it gets a foot or so high, and one when it gets into the spindle, so as to push it on. It is said by those who try it that that gives a better crop than by putting it all on at once. But be careful about the ammonia. I should get sulphate of ammonia; and always try to get the different elements from different sources, because they come along in different times. For instance, nitrate is ready as soon as it comes into the ground, sulphate wants a little more time. But barn-yard manure I would never plough under.

QUESTION. You have spoken of extracting nutriment from salt

water. I would like to ask you if you did not think there would be a famine of the finny tribe?

MR. GREGORY. No, because they do not feed on the salt water; they feed on what grows in the salt water. If you look at the stomachs of fishes, what do you find there? You find mostly the low forms of animal life. The first form is a vegetable growth, then a higher form that lives on that; that is the order—each living on the next lower; therefore nature takes care of itself, and you know we have the process of populating the sea by which we can obtain a million any time you want them.

MR. W. O. SWEET. Can you give us the formula for manuring grass land?

MR. GREGORY. I know less about that than anything I do. I never laid down six acres in my life. I keep taking up and taking up. They make up formulas for it, and have it enduring. I should do it in the form of ashes and bone. You can get potash cheaper in the form of muriate of potash, but ashes have all the elements of perfect manure in every respect except nitrogen—phosphoric acid, lime, soda, iodine, chlorine—everything. When I say bone, I mean bone rather coarse and fine together. Now I have got a piece of land—poor originally. It got run out. I put on it fifteen tons of bone—bone steamed to get out the glue waste, and ground in the mill—and I then used it on my crops, and I have had splendid crops of grass there ever since,—two crops a year ever since eight years ago. I would rather have the bone somewhat steamed—it makes it more digestible.

QUESTION. Where can you get ashes?

MR. GREGORY. Well, you can get any quantity you want from Canada. I get mine from Johnson, Munroe & Stroup, of Oswego, N. Y. It costs about 32 cents a bushel. There are several firms, but I rather incline towards them—they seem honest, and they have got an immense trade. They sell hundreds of thousands of

bushels every year. I get from them ashes that has no charcoal in it. Some of it looks so white you would think it had lime in it, but it is elm ash. The proportion of lime varies greatly. I had three car-loads last fall.

QUESTION. Does it come on a vessel?

MR. GREGORY. In cars they send them. They come from Canada, and I suppose they ship them wholly by cars; but if you write Johnson, Munroe & Stroup, you can get all the facts from them.

SENATOR OLNEY. What would you recommend as a top-dressing for wet meadow land?

MR. GREGORY. I haven't had experience in that,—I shall have to speak rather from inference. I would never put on a meadow any manure rich in ammonia. I would not put barn-yard manure on the meadow because it is mostly vegetable matter. I am speaking of a wet meadow. Is it muck?

SENATOR OLNEY. Yes.

MR. GREGORY. I wouldn't put barn-yard manure on it; I would rather put manure in some other form. I could not speak from experience on that. I would rather incline to ashes and bone. I think you could get enough nitrogen from the bone.

QUESTION. Wouldn't ashes do better on dry land than on wet land?

MR. GREGORY. Well, that is a curious state of affairs. When I was down in Maine lecturing I thought ashes were generally better on upland, but I found they had demonstrated ashes did better on clayey land. I expect the clay had potash locked up in it. Clay is decomposed feldspar, and that is the greatest source of potash in our rock; and this is a case where it doesn't apply—it didn't need it, so the thing is a mere experiment. Ashes do better as a rule on upland, but still on low land—sour land—potash would tend to sweeten it.

Mr. W. S. Hogg. Would you put on ashes more than once a year, and what would be the best time?

Mr. Gregory. The best time is always in the fall. Let it get dissolved and worked into the land. All potash manures are better in the fall. Let it freeze and the rains work it into the land.

Mr. W. O. Sweet. Does that apply to muriate of potash?

Mr. Gregory. Yes. Muriate is largely salt, and it is a little dangerous to use it directly to raise plants. If I was going to use it I would never apply it in the drill. I would wait till the cabbages got a going and spread it around broadcast, but not put it in before the seed comes up.

Mr. J. S. Budlong. How about applying stable manure to the land in the fall to be exposed to the elements during the winter?

Mr. Gregory. First-rate; we are all coming to that in the end —the sooner the better. It has been tested very thoroughly in New York State, on grass land. Put on in September it did better than any other, in October next better, and November next better. The reason was that the plants don't take the manure up—they take the elements in the manure. The water coming down from heaven and the frost tend to get them out. There is no waste from it in winter. It is a very good thing to put it on just as soon as it is made—you never lose by it.

Question. What does it cost you on an average to make your fertilizer?

Mr. Gregory. That depends on what I am making.

Question. As you find it in the market?

Mr. Gregory. I may say my potash costs me about four cents in the form of muriate, and my phosphoric acid about six cents, and my ammonia about six or seven cents. Let me read the analysis read by Prof. Caldwell, of Cornell University. He is first-class authority.

Cow Manure at $7 per cord	Nitrogen,	19c.	Potash,	6c.	Phos. Acid,	11c.
Horse Manure at $6.90 per cord,	"	14	"	4½	"	$9\frac{2}{10}$
Night Soil, at 43c. per 1000 lbs.,	"	$2\frac{8}{10}$	"	1	"	$1\frac{6}{10}$
Tanner's Waste, at 78c. "	"	1	"		"	15

In the form of tanner's waste the nitrogen is not available; it needs to be handled a long while before you can get it out. Now, in hen manure at $4 a thousand pounds (that is about the price we have been paying for it,) the nitrogen costs 27c., the potash, 8¼c., phosphoric acid, 15c. You see hen manure is entirely over-valued.

SENATOR OLNEY. I have seen some of the finest onions I ever saw raised from the use of hen manure freely. Have you ever seen that or tried it for onions?

MR. GREGORY. But, my dear friends, if you use anything freely you get a big crop—I don't care what it is; it is the *free use.* Now, a man told me last night, "I got onions four inches in diameter by using leached ashes and phosphates. I took a rod of land, put on two bushels of leached ashes and half a bushel of phosphates." Now, this is at the rate of 320 bushels of ashes and about four tons of phosphates to the acre. If my friend uses anything liberally enough he can get a good crop. But if you come to figure it out—the cost—you find you haven't made many dollars on it.

The meeting was adjourned after passing a vote of thanks to the speaker.

SIXTH MEETING.

The sixth meeting of the series was held at the usual place, on Thursday, Feb. 25, at 2 P. M.

Mr. L. M. Blodgett presided, and announced that at the next meeting there would be an address by Mr. Isaac K. Felch, of Natick, Mass., the subject to be "Poultry."

Secretary Smith was then called upon to read the reports of the experiments at the State Farm.

MR. SMITH. Perhaps, before I commence to read the reports, I might as well say that the next meeting in the interest of the poultry business was suggested by several of our members interested in poultry raising, and Mr. Isaac K. Felch, who is to address the meeting at that time, is among the best authority on poultry raising of any kind in New England; and those of you who are interested in poultry will undoubtedly receive many points of interest. If you are not interested in it personally, the committee would thank you if you would invite any of your friends who are interested in poultry to be present. I hope that the reading of the report will be followed by a full discussion of the results of your own experience in matters of a like kind.

REPORT OF EXPERIMENTS AT STATE FARM.

In February, 1884, at a meeting of the Standing Committee of the R. I. Society for the Encouragement of Domestic Industry, a committee was appointed to carry on some experiments at the State Farm. The committee entered upon the work, and selected an old run down and barren lot at the farm that had been plowed the season before, but had lain fallow.

The experiments for that season were confined to a portion of the lot, and the tests embraced ten plats of quarter of an acre each. On nine of these there were used manure and other fertilizers at the rate of $80 worth per acre, and the other plat was planted with no manure or fertilizer. The result was given in a report to the Society at one of the winter meetings.

April 15th, 1885, the Standing Committee appointed the same committee to proceed with the experiments another season, and they now are ready to report on their work.

By the request of several persons who had taken much interest in these experiments, your committee decided to take the same lot as last year and divide the plats in equal parts, applying to one part the same kind and quantity of fertilizer or manure as was applied last year, and the other part to be planted with no fertilizers or manures. These plats were again divided, as they were last year, in two parts, one of which was planted to corn and the other to potatoes.

The season was dry and the rains infrequent, and in this respect differed from the season before. In the season of 1884 there was a considerable drouth in June, but this drouth was broken about the last day of June, and from that time to the end of the season there was plenty of moisture. At planting time in 1885 the season was moderately wet, and at the time of planting these lots there came a rain, so that a part of the lots were planted the day before a rain and a part the day after a rain—the latter being planted two days later than the former. The following table shows the result of this portion of the experiments:

	Shelled Corn per acre. $80 worth Dressing per acre.	Stover per acre. $80 worth Dressing per acre.	$80 worth Dressing in 1884. Nothing in 1885.		$80 worth of Dressing per acre. Potatoes per acre.	$80 worth of Dressing per acre, 1884. Nothing, 1885.
			Shelled Corn per acre.	Stover per acre.		Potatoes per acre.
	Bushels.	Pounds.	Bushels.	Pounds.	Bushels.	Bushels.
Old Manure...........	61 23/70	6164	43 67/70	3341	167 54/100	66 10/56
Green Manure............	95 28/70	7262	69 27/70	3712	186 38/56	96 33/56
Commercial Fertilizers...	75 14/70	4731	50 26/70	3024	79 35/56	46 42/56
Clarke's Cove Guano...	80 58/70	6563	34 29/70	3147	127 18/56	91 16/56
Stockbridge Fertilizer...	83 58/70	5782	53 16/70	2765	133 13/56	83 41/56
Darling's Fertilizer......	83 60/70	5919	60 16/70	3492	138 4/56	91 16/56
Bone and Ashes........	......	.....	68 54/70	3600	....	99 40/56
Earle's Phosphate.......	72 67/70	3888	38 6/70	2801	138 34/56	62
Darling's Ground Bone..	44 9/70	2981	41 34/70	2751	129 34/56	45 27/56

Nothing....2502 lbs. nubbins, 1649 lbs. stover, 38 62/56 bush. small or pig potatoes.

The latter test where nothing was applied either year the corn was very small, a large portion having not half-dozen kernels on the ears, and none of it fit to sell. The potatoes also were very small and of the size generally denominated "pig" potatoes.

It will be seen in the foregoing table that where no fertilizer or manure was used this year that respectable crops of corn were raised, equalling in some instances two-thirds the crop raised on the plats where $80 worth of fertilizer or manure was used, and, as will be seen by the tables further on, to exceed the crops where $20 worth of fertilizer was used this year on new land. In the potatoes a still greater

result is reached, where in five out of the eight tests the plats not fertilized produced crops in excess of one-half on the plats that were fertilized with $80 worth this year.

In addition to the foregoing tests, other tests were made on the balance of the lot not used last year, and on soil, as was said in last year's report, "in as low a condition as it could be." This lot of land was divided as before in quarter acre lots, and these lots were again divided in one-eighth acre lots, one of them being fertilized with $20 worth to the acre and the other with $40 per acre; and on each of these smaller lots there was planted corn and potatoes, as were the former lots.

On these, as on the others, the dressing was spread broadcast and harrowed in, and in this respect differed from the tests of 1884; in those tests the dressing was applied in the hills. The following table shows the result from these tests, extended to acres rather than sixteenths of an acre:

	$40 worth of dressing to the acre.		$20 worth of dressing to the acre.		$40 worth of fertilizer to the acre.	$20 worth of fertilizer to the acre.
	Bush. of shelled corn to the acre.	Lbs. of Stover to the acre.	Bush. of shelled corn to the acre.	Lbs. of Stover to the acre.	Bushels of potatoes to the acre.	Bushels of potatoes to the acre.
Old Manure	$50\frac{7}{70}$	3667	$49\frac{25}{70}$	2819	$113\frac{21}{56}$	$104\frac{26}{56}$
Green Manure	86	5000	$62\frac{52}{70}$	4436	$192\frac{51}{56}$	$142\frac{2}{56}$
Commercial Fertilizer	$47\frac{62}{70}$	3964	$49\frac{41}{70}$	3377	$116\frac{29}{56}$	$75\frac{21}{56}$
Clarke's Cove Guano	$54\frac{35}{70}$	4320	$55\frac{56}{70}$	3615	$177\frac{32}{56}$	$131\frac{26}{56}$
Stockbridge Fertilizer	$75\frac{39}{70}$	5343	$53\frac{38}{70}$	3449	$138\frac{43}{56}$	126
Darling's Fertilizer	$80\frac{28}{70}$	4299	$57\frac{13}{70}$	2938	143	$101\frac{50}{56}$
Earle's Phosphate	$49\frac{25}{70}$	3831	$49\frac{5}{70}$	2762	$91\frac{42}{56}$	$86\frac{30}{56}$
Darling's Ground Bone	$70\frac{4}{70}$	3586	$37\frac{2}{70}$	2664	64	$59\frac{25}{56}$
Church's	$76\frac{36}{70}$	3252	$39\frac{10}{70}$	4187	$95\frac{26}{56}$	91

The following table will show the comparative results of the tests where no fertilizer was used this year as against those tests where $40 and $20 worth was used:

	No fertilizer in 1885.	$40 in 1885 on new land.	$20 in 1885 on new land.	No fertilizer in 1885.	$40 in 1885 on new land.	$20 in 1885 on new land.
	Bushels of sheiled corn.	Bushels of shelled corn.	Bushels of shelled corn.	Bushels potatoes	Bushels potatoes.	Bushels potatoes.
Old Manure................	$43\frac{67}{70}$	$50\frac{7}{70}$	$49\frac{25}{70}$	$66\frac{10}{56}$	$113\frac{21}{56}$	$104\frac{26}{56}$
Green Manure.....	$69\frac{27}{70}$	86	$62\frac{52}{70}$	$96\frac{33}{56}$	$192\frac{51}{56}$	$142\frac{2}{56}$
Commercial Fertilizers.. ...	$50\frac{26}{70}$	$47\frac{62}{70}$	$49\frac{41}{70}$	$46\frac{42}{56}$	$116\frac{28}{56}$	$75\frac{21}{56}$
Clarke's Cove Guano..	$34\frac{29}{70}$	$54\frac{35}{70}$	$55\frac{56}{70}$	$91\frac{16}{56}$	$177\frac{32}{56}$	$131\frac{26}{56}$
Stockbridge Fertilizer	$53\frac{16}{70}$	$75\frac{39}{70}$	$53\frac{38}{70}$	$83\frac{41}{56}$	$138\frac{43}{56}$	126
Darling's Fertilizers.........	$60\frac{16}{70}$	$80\frac{28}{70}$	$57\frac{13}{70}$	$91\frac{16}{56}$	143	$101\frac{50}{56}$
Earle's Phosphate........ ...	$38\frac{6}{70}$	$49\frac{25}{70}$	$49\frac{5}{70}$	62	$91\frac{42}{56}$	$86\frac{30}{56}$
Darling's Ground Bone.......	$41\frac{34}{70}$	$70\frac{4}{70}$	$37\frac{2}{70}$	$45\frac{27}{56}$	64	$59\frac{25}{56}$

The committee do not feel like closing this report without expressing the regret we feel by the resignation of Mr. Hunt as Superintendent of the State Farm. The idea of making these experiments was suggested by him, and to them he has given very much attention, and is entitled to the credit of carrying them out so successfully. He has personally superintended the crops from the plowing of the land to the harvesting of the crop, and we may all feel assured that the work has been done faithfully, and whatever results have been arrived at are the true measure of work well done.

The committee hope these experiments may continue for years to come, and be enlarged upon each year, until we have what we ought to have—an experimental station that will be of great value to the farming community.

OBADIAH BROWN,
BENJ. COMSTOCK, } *Committee.*
C. W. SMITH,

QUESTION. Allow me to inquire how the corn was estimated?

MR. SMITH. Weighed in the cob—70 pounds to a bushel. We had the advice of several old farmers together with the farmers on the committee, and thought that was a fair proportion to measure it.

LISTENER. That would be a very fair rate till you come to the nubbins; I guess they wouldn't hold out.

MR. SMITH. We have not estimated anything on the nubbins.

LISTENER. May I inquire if the corn was dry?

MR. SMITH. It had been recently husked—weighed immediately upon taking from the field. I think that is a point for future experiments, that the corn should be kept by itself for a reasonable time for it to dry, and then weighed. I think the committee agree with me in that.

LISTENER. Was there much apparent difference in the ripening of the corn?

MR. SMITH. I think not, sir. Can you give us your recollection, Mr. Brown or Mr. Comstock?

MR. COMSTOCK. Well, it ripened about all alike. I didn't perceive any difference to speak of.

MR. SMITH. As a member of the committee I will say I did not see much of the latter part of the crop because it came at the time when the State Fair was being held, and it was impossible for me to see it; but I think Mr. Comstock saw it more frequently. It was all well ripened before harvest.

QUESTION. With reference to the stover, when was that weighed? after it was dry or before?

MR. SMITH. After it was dry, but immediately on taking it from the field—after it had been cured in the usual way, and then after a space of time it was weighed.

LISTENER. Weighed when the corn was husked, was it?

MR. SMITH. Yes; it was cut up and cured in shocks. I presume it was weighed after it was husked, but after standing in the field a few weeks.

QUESTION. Mr. Secretary, where you read in this last report of using $40 and $20 worth, was it entirely new ground?

MR. SMITH. Yes, sir; new ground.

MR. POTTER. That old and green manure seems to bother me a good deal, and I would like to ask how old the old manure was?

MR. SMITH. The manure used in 1884 was manure brought from Boston in the fall of 1883, and kept out doors in a pile by itself.

MR. POTTER. Was it kept through a part of the warm weather or only cold weather?

MR. SMITH. Only cold weather; got in the fall—late, and kept through the winter.

MR. POTTER. And the green manure was the same—Boston manure?

MR. SMITH. No, sir, that was not. That was the difference, perhaps, in your reasoning of these matters. The green manure was taken directly from under the stables on the farm both years.

MR. POTTER. How long had that been in becoming old manure?

MR. SMITH. Which one do you mean,—this year or last?

MR. POTTER. This year. You say this was manure made on the farm—the old and the green both?

Mr. Smith. Yes; this year we used the old made on the farm and the new manure made on the farm. The old was on the farm during the summer of 1884.

Question. Was it lying in the barn cellar or composted?

Mr. Comstock. It was turned out and composted in a heap.

Mr. Potter. Because when old manure does not produce near as much as new manure it is upsetting all our theories and our grandfathers' too (and we have great respect for our grandfathers,) and there must be some reason somewhere about this, as the gentleman has reported in his paper. You see, if green manure is better than rotten manure, you and I throw away a good deal of time and money. Now, again—was that old manure the same quantity as the new, or was it what you purposed to be the same quantity rotted down?

Mr. O. Brown. The theory we had about it was that manure would shrink one-half, and on that basis we acted.

Mr. Potter. That is a very important thing, you know.

Mr. Brown. The compost did actually shrink one-half in bulk by measurement.

Mr. Potter. Some folks say figures can't lie, but I tell you, sir, figures can be made to represent lies. Sixty-one will represent sixty-one lies as well as sixty-one bushels of corn. If it is true that green manure is so much better than old manure, why, I think there has been a great deal of waste, and it is something that I can't understand. Two years won't make me believe it, because one blackbird don't make a spring, and two don't, either. I want more than two to satisfy me. I don't question anything;—this is the most interesting experiment we have ever had. At the State Fair I guess a hundred came along and said, "Well, well, if these are the potatoes we raise at the State Farm, we had better sell out. If we are putting in all this money to raise *those* potatoes, we had better keep it at home." If they had understood the facts of the

whole thing they would have learned a splendid lesson,—if they had put somebody there to explain, it would have been the best lesson in this State. They knew nothing, and they said, "Well, this is the State Farm!" I think we are putting a good deal of money into the State Farm,—it is small potatoes anyway. I don't question anything, but there is something that don't suit me with regard to using manure. Sir, my principle has always been to get the manure on to the farm just as soon as possible. I wouldn't like to spread it on in hot August season, and I wouldn't like to do as a friend of mine did—spread it on when the snow was a foot deep, and since then the water has run a foot deep. I guess the manure is in a swamp—(laughter)—but I tell you nine winters out of ten it would have been safe—it would have gone down; but this was one of the unforeseen circumstances that my friend couldn't plan for.

LISTENER. I would like to inquire if potatoes represent large and small, or only marketable potatoes?

MR. SMITH. It represents all that are produced — large and small.

MR. S. F. PECKHAM, Bristol. I can heartily join with the gentleman who last spoke in expressing my entire satisfaction with these experiments. I think they are extremely interesting and valuable. I think there is one question in reference to them that would occur to the chemist at once. We all know that all material like corn, or corn fodder or corn cobs will vary in the amount of water which they will hold with the condition of the atmosphere from day to day, and even with different parts of the day; and that fact would, from the standpoint of the chemist, vitiate to some extent the figures given with reference to the corn and stover; and I think any one whose attention is called to that figure, 95, will at once be struck by the immense weight of corn represented as grown upon an acre—4,750 lbs. Now, weighed as that was upon the cob, we

very well know that corn that grows very long requires longer time to ripen than that that grows with less vigor, and we oftentimes find that the most vigorous ears of corn are those that hold water. There is no doubt that with the green manure the corn was most vigorous in its growth. I question if there was as large an amount of water extracted from that corn in ripening as from the other crops; and I have no doubt that the very large figure is due to the much greater percentage of water than is represented by any of the other figures, even the largest. And I would suggest that from a chemist's standpoint (if these experiments were repeated) that they might be made much more valuable if the material was reduced to the actual dry content of corn or stover. It would not be difficult to try a certain portion—a certain average proportion—of corn and stover representing the corn from which these portions were taken, and reduce them to the dry content at a temperature of boiling water. And if a chemist had prepared the table he would have done that and removed all the hydroscopic water in order that the comparison might be made in the actual amount of corn, (dry material)—these variable elements being by that means almost entirely removed.

Mr. Smith. That point has been discussed by the committee, and it occurred to them that it ought to have been measured and weighed at a later date. It did not occur to me that we ought to have saved out a bushel or so and tried it in the way you suggest, but it might just as well have been done although we did not do it. The point you have taken is a very good one; for those who shall have charge of it in the future it will be a suggestion worth having.

Mr. Potter. I think, sir, these tables represent the average condition of things as it was. The gentleman says it represents a large proportion of water. There is no doubt about that, because it was a larger growth. I have no doubt there is more water in that particular sample than there was in the other; but when you

compare one with the other it seems to me to be as near right as you could get it, unless you had it dried and analyzed, and we can't be expected to go in and dry it and analyze it,—we have got to take it as the farmers use it, and that presents it before us as we receive it and do the work with it. I think it is very fair, but still the gentleman has suggested that it was probable that with the greatest growth of corn or fodder there is the most water; and when we talk about 94, 81 and 84 bushels of corn with $80 worth of manure on land that wouldn't produce anything without it. The corn should not be weighed till April; March winds dry it more than any other month. The way to get a fair crop of corn is when it is fairly dried and shrunk. Talk about 84 bushels of corn on that land! I have seen it,—it will hold that part of the world together, and that's about all it has done for a great many years. I should judge by the looks of it that it won't make 84 bushels of corn in one year with $80 worth of manure. It can't be done—you are weighing water.

MR. SMITH. You must recollect this is the manure for two years—$80 worth to the acre.

MR. POTTER. Yes, but this table shows when it was husked before it was weighed. There is no way to get that water out unless you wait till August, or kiln dry it;—there is no other way to do it to get it out. But, comparatively speaking, it is a splendid view of the thing.

MR. C. F. PECKHAM. I don't wish to take up too much time, neither do I wish to be discounted as a farmer by being called a chemist. I have hoed my rows of corn and I understand it perfectly, although I know something about chemistry. It is not necessary to dry the whole crop or analyze it at all. A table has been made which is a fair sample. If it was dried in the temperature of boiling water till it ceased to lose weight by any reasonably accurate balance, it would give all the results that are required.

Mr. Potter. I am not a chemist, sir, by any manner of means, but I suppose chemistry is taking things apart and examining them separately; and, if you take the water out, so far you are analyzing, are you not?

Mr. Peckham. No, sir.

Mr. Potter. I supposed when you got a part of it and told what it was, you had taken it to pieces so much and it was so far analyzed. I am ignorant, sir.

Mr. Mowry. It was said by the gentleman the other day that it was necessary for a farmer to be independent. It was well said that when men begin to lose their individuality the State begins to decay, and we all know that to be a matter of fact. Any committee acting for the State of Rhode Island, (for I understand now the State has furnished something to carry on the experiments with,) of course must expect to be criticised somewhat—nay, they ought to be; and if we are making experiments for the State, every citizen that pays a tax has an interest in these experiments, and we ought to get upon a correct basis to start with. And now that is the question—in regard to analyzing the different kinds of fertilizer they have to come down to a certain point. You recollect what Mr. Gregory said the other day. He said his experiments confirmed the experiments of the Connecticut station, where they had tried fifty-three experiments; and what was the result of those fifty-three experiments?—that you could get all that was necessary to grow a good crop of corn for $8 or $9 in commercial fertilizer. That was their experience as he read it from the experiment station, and he said his own experience confirmed it. Then taking that as a basis, (and I have in my pocket here a paper that I took from the Massachusetts reports, where one man raised on one-sixth of an acre, with Prof. Mape's fertilizer, 100 lbs.—twenty-five bushels—of shell corn; at the rate of 600 lbs. to the acre that would be 150 bushels of shell corn to the acre from 100 lbs. of

fertilizer. And what is that?—that is about 2½ cents a pound. I think Mape's is quoted at about $48 per ton,)—now, then, it seems to me that it is a question whether this committee have started right in the first place. If we can raise crop as Mr. Gregory says, and I say, and all chemists, I may say, I would like to know if there is one of these commercial fertilizer people who would recommend your putting on more than one ton. Most all of them talk about trials of from 800 to 1000 lbs. as being sufficient to the acre,—growing a crop by this. I find in that very report that some farmers use as high as one ton and recommend using one ton, and that where they used one ton the reports show they got 300 bushels of potatoes to the acre; and, of course, the cost of that, we know, is about $40 per ton. Now, I say, with these figures before us for putting on commercial fertilizer, is this committee, acting for the State of Rhode Island, spreading out these reports to-day for the benefit of the farmers of Rhode Island, justified in going and spending $80 to the acre when you could get 150 bushels with Mape's fertilizer with 600 lbs. to the acre, which costs about $15? And you recollect Mr. Gregory the other day compared $15 worth of fertilizer with five or six cords of manure, and there would not be very much difference in the cost between them. If you took a ton of ordinary commercial fertilizer—what we call "Standard"—that would come to about $40 per ton; five cords of manure would come to somewhere in the neighborhood of $40. Of course, everyone here could have their choice,—I should not hesitate, notwithstanding these fertilizers. My friend here says sometimes figures tell very big stories—

Mr. Potter. Represent, I said.

Mr. Mowry. Represent. If we should be governed by these reports—by the figures that we find in these commercial fertilizer reports—we should think we could soon get rich at farming; but

they don't always come up. Now, I did want to ask you a question or two with regard to these potatoes, for in some of these commercial fertilizers and manures there I see there wasn't much difference between $20 and $40 worth. I want to ask how the size of the potatoes compared with the $20 and $40—if any of the committee recollect?

MR. COMSTOCK. Where there was no manure we had the smallest potatoes—probably there wasn't one big enough for market in the whole eighth of an acre; the rest were small and valueless as a general rule, but where there was more fertilizer the crop was better.

LISTENER. Well, I can't, of course, carry all these in detail in my mind as it has been read off and exhibited; but as I looked it over at the State Farm, I thought with potatoes where $40 worth was used you got as large a crop as you had upon any quantity—in raising the potatoes $40 worth was equal to the $80 worth.

MR. SMITH. What test did you have reference to?

LISTENER. Well, I saw them at State Fair. I don't know what your figures are here—I couldn't see all of them.

MR. WINSOR. It shows it there to be the case that $20 worth produced as much as $40, and more in some cases. I should judge that was the lesson that this thing is meant to teach. Whether it is more profitable to use $20 or $80 worth is what we are paying for the knowledge.

LISTENER. Yes; we can look at that. There may be some mistakes in the small detail, but as far as the whole thing goes it shows that the crop can take but so much; whatever more we apply remains or goes somewhere else.

MR. SMITH. For instance, green manure,—here is 69 bushels with $80 worth, and with $20 worth we raised 62 bushels.

A LISTENER. That is a case of over-feeding, I should judge, when you used the $80 worth.

Question. How much did you raise with the $80 worth ?

Mr. Smith. With $80 worth we raised 127 bushels.

Question. How much difference is that ?

Mr. Smith. The difference is in favor of the $40 worth.

Mr. Mowry. Well, that was the very point I wanted to get at, and it seems to me that is a very essential point for the farmers of Rhode Island to get at. You know what Mr. Gregory said the other day. He said there were certain parts that were not lost if you put them on, and other parts that were lost; and I want to call your attention particularly to his argument. Notwithstanding he was a college graduate, it seems to me it wasn't logical from this fact,—when questioned with regard to using fertilizer, whether he would put it all on at once or not, he said, No, it did better to put it on at three different times. Well, then, if it isn't lost, it might as well all be put on at once, and save a little trouble. That was his statement, but he did admit that ammonia was lost—that it went away, but there were certain other parts that were not lost; and, as I say, you take your experiment station—take all the analyses that I have seen anywhere with regard to these fertilizers, and for ordinary crops, of course, that is the main thing for the farmer to do. The question is whether you can get any farmer to pay for it. Now, to come right down to the point, I was talking to a man right in my neighborhood who used some last year—he used Stockbridge's, and he put on some $24 worth to the acre—and that corn has been selling at auction at 60 cents for 70 lbs. He said that would just about pay for the fertilizer and would leave him the stover for cultivating. It seems to me that is the point—if we can't gain a little more than the bare labor, it wouldn't do, sir, for the farmer to go into raising corn for the purpose of making an income from it unless he had some other object than making money for future need. As I say, these experiments are the most important that the farmer can

have, but we want to understand the right basis. As I said before, the State of Rhode Island has looked at this, and when they begin to aid this society by money it will criticize it pretty closely to see whether we gain any point. And now, as I said before, if we start with $80 worth, when all the commercial fertilizer people say that $7 or $8 or $15 or at least $40 worth is all that they would recommend to put on to the acre, we ought, as the saying is, to rub out and begin anew, or at least to start right. And, as I say, I want to call the attention of this committee and the people to this point—and it seems to me that is the main object of all these experiments—and if we are going back and going over what has been gone over,—in other words, all the experiments with regard to the chemist heretofore,—why, we are coming up to experiment as if there had been no experiments. Let us profit by those experiments heretofore. If they have had experiment stations in New Jersey, Massachusetts and Connecticut, and been experimenting for years—do we want to get an experiment station in Rhode Island and throw aside all experiments and go back to the original and commence as if there had been none made? It seems to me it is not wise. It is one of the points I make here—that if we are to gain by these experiments, let us see and profit by them; and if we are going to continue our experiments, let us have these for starting points. When we come to look at the fact that the United States spends $28,000,000 for fertilizers annually—Rhode Island $140,000, and Georgia $4,000,000. Illinois produces $203,000,000 annually from farms, and doesn't spend but a little more (of course, being a new State) than the State of Rhode Island for fertilizers—it has something like $170,000; and Georgia that spends $4,000,000, her farms don't produce but one-fourth of what Illinois does. It has been said and we know that we must use fertilizers. Why? Because we can't get barn-yard manure enough away from the cities and villages.

Now, the question is, if we get fertilizer,—and here it is evidence where we see in the Connecticut report for this year some sixty new manufacturing establishments started in that State—(there is one in Pawtucket),—now, when we see all these new fertilizing establishments starting up, it ought to open the eyes of the people of Rhode Island. Now, whether the fertilizing companies are getting rich or the farmers are getting rich—it is pretty evident that the farmers are not all getting rich, from the evidence that my neighbors have had in their experiments. As I say, I saw a man put on an acre about $12 worth, and the corn looked remarkably well and he thought he was going to get a good crop, but he didn't plant quite early enough. He got about twenty-five bushels of merchantable corn to the acre, but a good deal of small corn. Now, then, all I have got to say about this matter is that I want the people of Rhode Island—if they continue these experiments and the State furnishes money—and, of course, it comes out of the people,—I want the farmers to get the benefit of it; and as Mr. Gregory said, if we can get a fertilizer, and I believe Mape's stands as well as any others. In Massachusetts on rather poor soil they got 150 bushels of corn to the acre with $15 worth of fertilizer,—why should we put on $30, $40 or $50? That is the point. I would say here in confirmation of what Mr. Gregory said in regard to that—I know in one case where they got a large crop they put on two or three different times, as he recommended; and I haven't any doubt in my own mind that it is better unless you put on a large quantity, and it seems to me that the large quantity is not all taken up by the crop.

Mr. Potter. Mr. President, the gentleman has made some very good points indeed, but it is a principle of mine always to defend the absent. Mr. Gregory isn't here to defend himself, and I want to say a little in his defence. The gentleman says the fertilizer manufacturers are getting rich. Mr. Gregory says every

farmer should be educated till he could buy the raw material and make his own fertilizer, then he would know what he had and he could adapt it to his product—such as it needed, and he would save the carting of immense quantities of stuff put in to make up the bulk. He would make money and save it. The gentleman speaks well about the fertilizer. There is no doubt there has been a good deal of humbug going in fertilizers, and we have been humbugged. The chemists now understand their business better,—they are watched closely, and they are now, as a general thing, making a very good article indeed. Yes, gentlemen, and I can remember when there wasn't any kind of commercial fertilizer in the country; and I recollect a man who had a smattering of chemical knowledge, and he went to an old Quaker and he said, "Look here, I can make thee a fertilizer that thee can take in thy vest pocket and go out and fertilize a whole acre,—I have got it and I can do it." "Oh, yes," said he, "I know you can—my pocket is a pretty large one. But," my friend said, "when we come to the harvest I could bring it in the other pocket, you know." Now that is about the way the commercial fertilizer worked at first,—that is about the way they worked then. There's $80 worth produced 61 bushels of corn—did you say it was worth 60 cents per bushel?

MR. MOWRY. I don't know what that was worth, but my neighbor was selling at auction for 60 cents.

MR. POTTER. We'll say, then, $80 worth of fertilizer produced 61 bushels of corn worth 60 cents a bushel. We wouldn't need to have a very large pocket, you know. But I tell you this is a capital thing, and I am glad you called my attention, sir, to the fact that it is not necessary to put on $80 worth of fertilizer when $40 worth would do the work. There are a great many things that ought to be studied and studied deeply; and when we get through with the whole thing we can't farm it by the square rule nor by the scale. A man can build his cotton machinery and put

it together and it will work like a charm; he can build the machinery of a watch and it will work like a charm—but you can't go on to the farm and say, "so many loads of manure will produce so much crops." Perhaps there will be rain, perhaps there may not be rain, perhaps there will be frost, perhaps he will have worms—you cannot farm it by the square rule and no other rule. The best thing to fertilize the farm with is brains. Give us all the fertilizer we can get if we can afford to get them.

MR. J. A. BUDLONG. I want to say something, but I hardly know how to begin—there has been so much said and so well said; but the criticism that has been made in reference to this trial I don't like one bit. Fault has been found with applying $80 to the acre. We shouldn't have been satisfied with the trial if it hadn't been done. I think it was very important that we should know whether $80, $40 or $20 worth was best, so we need to have different tests and trials. And then about the money it costs—why, I doubt if my brother would be willing to part with the knowledge he has obtained from this experiment. He can apply it in his business so as to realize more profit than all the money that has been expended in these trials. I haven't known of any money to amount to much of anything being so well placed. There has never been any money in Rhode Island appropriated for any purpose that has paid or can pay better. I don't like to hear this fault found with money being wasted,—it is just what we do want, and these trials we ought to have. They talk about what has been done in Massachusetts and Connecticut, but we don't have time to look that up. We ought to have one right at home. I have longed very much for it, and I have been very much interested in it, and I hope it will be done. And then, again, one says that kind of farming—applying $80 worth of manure and getting 61 bushels of corn—will never do; that is going to impoverish everybody that goes into the

business. The gentleman who said that has made a good farm, and I don't know how much money he has got at interest in doing just that business.

MR. POTTER. I am glad to hear that I have money at interest; I didn't know it. I believe I said that figures would represent things badly. I think we'll set that down as bad representation. I don't know where I have made the money. With all due respect to my friend, I don't wish to be understood as censuring the committee by any manner of means. As you say, it is just an illustration; but I don't want us farmers to suppose it would do for us to put $80 worth against $36. If that is the way I made my money, if I have got any—why, it is rather queer. You, sir, nor no other man, cannot recommend a man to farm it in that way. You pay more than $80 to the acre, and so doing produce 61 bushels; and I don't wish it to go before these farmers that if they pay $80 for old rotten manure—there is something lost in rotting it: time, which is money—and get 60 bushels of corn, they will get rich. I think they had better look into that a little. I can't figure it out in that way.

MR. SMITH. I wish to correct an error. They reckon 61 bushels of corn as against $80 worth of manure. They forget that on another table which is here that 78 bushels was raised last year, 61 bushels this year—139 bushels both years—and 7,492 pounds of stover was raised with $80 worth of manure. I mean to say, the crop raised last year with $80 worth and the crop this year without any fertilizer, on the same land, amount to 139 bushels of corn and 7,492 lbs. stover.

(A motion is here made, seconded and passed, that each speaker be allowed but five minutes.)

MR. MOWRY. We have got amongst other things an Agricultural Board, and of course it will cost something to have an ex-

periment station, and they ask something for these experiments. I have been in my day in the legislature, and I know something about what kind of people come from the country up there—and that is the point I was going to make. A few years ago, you know—and Mr. Comstock will recollect it because he was there—a certain sum of money was given to Brown University for the purpose of an agricultural department. Certain men in the city offered to furnish $10,000 if the State of Rhode Island would appropriate $10,000 more, for the purpose of carrying on an experimental farm—having an experimental farm attached to Brown University. And what was found? Almost all the farmers in that legislature, except Mr. Comstock and myself, went against that legislation under such circumstances of appropriating $10,000 when these other people would raise an equal sum to make it $20,000. And that is one reason why I know that if you undertake to carry on these experiments and ask the State to furnish the money, they will criticize it pretty closely and be a little careful. Mr. Brown is well aware of that fact, and for that reason, I say, we want to get as much benefit out of it as we can, and the legislature want you to do it as cheap as they can.

Mr. E. C. Baker. The officers and members of this association will excuse me for rising, but I feel very much interested in this subject. It is one that concerns all mankind—if not directly, surely indirectly—for those who are not consumers are producers. I am somewhat interested in these commercial fertilizers and very much interested in the reports here to-day; and I represent one of the fertilizers there. It shows about as small a percentage as there is upon that paper. When the test commenced the land was not selected, but the fertilizer was manufactured, and you see by my cards and circulars that the potash represented in my fertilizer is less than 2 per cent; all the other ingredients are quite high. I didn't see fit to add more potash to my fertilizer, which I know,

if you will, would make a great difference in the crops. But let it go as it is. It was the experience I had with my fertilizer in using it upon stony ground. I always calculated there was enough potash in it to produce the crop; but upon land that was not stony of course the chemists will tell you that there is not potash enough. Now, adding to my analysis the potash that is put into others, you will see it makes a great difference to the crop. By comparing with chemists they can tell you what a good fertilizer is. I wish to say one word with regard to this commercial fertilizer. Now, gentlemen, to make a fertilizer of the four parts of the fertilizer, which are nitrogen, phosphoric acid, phosphate of bone and potash, the equal parts of which—(if you look in the paper you will find the current prices, 6c., 4½c. and 16c.)—will make a ton of fertilizer, costing you $116, or we will say from $100 to $116. And, sir, you have some land to plant, and you want to get 100 bushels of corn;—you go to the chemist and ask the chemist what to put on that land for that 100 bushels of corn, and he will tell you so much potash, so much phosphoric acid, and so much nitrogen and so much phosphate of bone will give you sufficient quantity for 100 bushels of corn—if your land is in the right condition to receive it. Now, gentlemen, with that fertilizer that has cost so much and the best kind of fertilizer you can make, you will find 10 per cent. will raise you an extra crop of rye.

MR. W. H. HOPKINS. Mr. Chairman, I will say a word in defence of our committee in relation to the amount of money which they have laid out. None of us farmers would have known to-day, if they hadn't expended $80 worth of manures upon an acre of this poor land, whether it was best to put $80, $20 or $40. The manufacturers of fertilizers have been alluded to as saying that from $15 to $18 worth is the proper quantity to put upon our land. If the land is well manured with stable manures and in pretty good condition, I have no doubt it requires a large quantity of special fertilizer; and

these experiments are calculated to give us a good deal of information we could get in no other way, and I think the committee have been fully justified in doing as they have done—putting on large quantities and reducing them down, as it shows here the results. It is true the figures do not show exactly what we may have expected, but there is probably some difference under which they gave $20 just as much as the $40, or even more, because of depression in the land. This was done upon a very small scale, and certain depressions in the land would make some portions richer than others. I merely throw this out as a suggestion. I don't want to go away and feel that our committee have been censured.

Mr. Potter. I hope the committee do not understand me as wishing to censure them by any means. As I said, it was the best thing to put it before us, and we see now we don't think it best to spend $80 and get $65. I did not mean to censure. I think it is a very good thing.

Mr. Smith. I don't think Mr. Mowry and Mr. Potter wish to say anything captious,—so far as I am concerned I receive it in good part. I am very glad of the criticism here made. Our view was to see what high manuring would do, and it was afterwards suggested that we try experiments with less quantities, and we found that less quantities paid better than large as they succeeded just as well. We raised 256 bushels of potatoes with $80 worth of manure; it lasted over two seasons,—the first season we got 165 bushels, the second 91 bushels. Then, as our result shows here, it is more profitable to use $20 than $80 worth unless you are going to get something for next year or maybe for three years.

Mr. Mowry. Mr. President, we are here for the purpose of ascertaining the truth; and if we have been experimenting and made mistakes one way and another, these experiments will doubtless tell us that fact—(they wouldn't be experiments if they didn't.) We are here for the purpose of ascertaining whether it is profitable

to expend fertilizers to put them on our crops—that is the purpose. And now, as Mr. Hopkins has said, we should not have known without these experiments. It is very true we should not have known about these particular experiments, but are you going to ignore all the experiments and all the chemical analyses and calculations the chemists have made from Leibig down to the present time? When he speaks about nitrogen in corn, he says that is one of those crops that gather nitrogen itself; like the clover, it isn't necessary to put on so much for a crop of corn—it gathers it from the air; but I say I am not going to ignore all these experiments that the chemists have been making all these years, analyzing all these different kinds of fertilizers and letting us know what kinds of fertilizers we want to put on for certain kinds of crops. I know a few years ago the chemists told us to bring up your soil and we'll analyze it, and then we can tell you just what kind of a crop. If you tell us what kind of a crop you want to raise, we can tell you what kind of fertilizer to put on to raise that particular crop. What was the result? The result was a good deal like a man out my way who used to be in the habit of drinking. One time he went in to get a glass of liquor; he asked the man for a glass of liquor and he let him have it, and after he had drunk it he said, "I haven't any money to pay for it." "Why didn't you tell me that before?" Said he, "I tried that several times and it didn't work." We found the chemists' analyses of the soils didn't work. But they can tell us what kind of ingredients certain crops need, and we can tell, as Mr. Gregory says truly, with regard to feeding and anything of that kind, what passes away from it does not contain any more than what was in the ingredients—what went into the animal. There is no question about that,—so that we have to come down to that point. We have to take something for granted, and I think it is a good point.

Mr. Budlong. I think one of the most important elements in

this series of experiments is the fact that those who conducted these experiments took some of the land, which, as the gentleman said, was only fit to hold the world together—there is no meaner land anywhere. This information cannot be gained by trying experiments in the fertile valley of the Connecticut or New Jersey's mild soils. We want it right here on these old granite soils, and they are extremely valuable experiments. They ought to be performed right here at our doors.

LISTENER. I think the gentleman has got that about right too.

LISTENER. Do you understand this report to show that barnyard manures and night soils are good for nothing?

SECRETARY SMITH. No, sir, I don't see any such thing in that report. In these experiments this land was the very poorest that could be found—in as low a condition as it was possible to find land, and, as Mr. Budlong knows, it couldn't have been much poorer.

MR. BUDLONG. About equal to blue sky;—I have heard of land being about that value. In regard to Mr. Potter's remarks about these experiments and what they show, I know of no way of coming to a conclusion other than the final result of what comes of any work after a long series of years. Now, Mr. Potter wouldn't pretend, notwithstanding these experiments, that the first case of raising corn and using more money than the corn sold for was a failure,—if he does, it is only for the sake of argument. It rather shows that in two years the crop more than paid for the manure and labor, and no gentleman here that has had years of experience in farming can tell us how many years is needed to take the manure out of that soil. Nobody here knows whether it is all gone in five years, or whether some of it isn't there after ten years have passed away. We all know one thing, and those who have criticized those experiments know that to try to farm without fertilizing is a failure,—they admit that. I want them to show me how they

will farm it without fertilizing. I never saw anybody succeed without it, and I believe the experiments show us how to use it,—how much, and what. I am surprised at the result and the value of the different kinds of fertilizer,—they are much more valuable than I ever supposed they were. I am very much pleased to see it is so, for it helps us in farming. It is settled that we have got to have fertilizers to farm it. I don't believe these men who found fault with that result are ready to undertake any other way of farming it. You have got to take your land and make the best of it with your manure. There is no other way but to go on and use the fertilizer. As somebody said here, where the least manure was used the potatoes were the poorest, and the farmers that used the least are generally the smallest and the poorest.

MR. POTTER. I didn't mean to say anything more. I thought that when I first got up and said that these were the most beautiful illustrations and most valuable, I said enough. I only told you how it was ridiculed, and I thought it ought to have been explained. I don't think it right to say Mr. Potter has been finding fault;—he doesn't find fault with spending $80 and getting sixty bushels for it. I don't want to misconstrue any of your ideas at all. It seems to me it is hardly fair; but I am old and tough, and if you have got any more I am perfectly willing. That is the best table I ever saw, and when these things were exhibited there, if there had been anybody there to explain, it might have been a grand lesson to the farmers in this State. I say now that $80 when it produces sixty bushels of corn isn't a profitable manuring, and you turn round and say that I am making money in that way. I can't see it.

MR. HOPKINS. When Mr. Potter was there, I wonder that somebody wasn't there to make an explanation. (Laughter.)

MR. POTTER. I had other fish to fry; but it is true I introduced the matter to a great many ladies and some gentlemen, who said:

"What kind of management have they got over at the State Farm? I guess they might as well sell out."

Listener. Mr. Chairman, I wish to make a certain statement in reference to these facts. Take one of the fertilizers that has produced the most—say 84 bushels of corn at 60 cents a bushel comes to $50.40, and stover at 10 cents per lb. would be $30, making $80.40,—40 cents over the price of the fertilizer. You see where the $40 worth is used you get 80 bushels at 60 cents a bushel, which is $48; stover, 2 tons at $10 a ton, would be $20, making $68; and taking out the cost of the fertilizer, leaves $28. And then, with the $20 worth of fertilizer, 57 bushels were produced, which comes to $34.20; stover about 3 tons, which is $30, making $64; and the cost of the fertilizer being $20, leaves $44 profit. Probably there are others here that have had experience. I would ask them if they would recommend putting on $20 instead of $10 or $80 worth, if they think they would have the value over the others in the years to come.

Mr. Smith. These other experiments were tried this year without any manure where we used $80 worth last year, and that will in part answer your question.

Listener. It is evident, Mr. President, that there is more profit for the present year in the $20 worth as he figures it. Whether it would be so for years to come is a matter of experiment and experience. It would depend on whether you own your farm or hire it.

Mr. Budlong. I would say on that point that I have been of the opinion for some time that it will not do for a man to manure up poor land when he does not own it. If he hires it and lives on it a year and undertakes to make money, it is a failure every time. If he farms it with fertilizer, if he goes to work to expend money plentifully, it takes more than one year to succeed in farming, especially in using manure. You will find your land improving

and your crops getting better at last, but it will not be the first year.

LISTENER. Would you recommend using $80, $20 or $40, or somewhere between?

MR. BUDLONG. I certainly would not recommend $80 for those crops. It might be best to use $80 for crops that sell for more money. I am always in a hurry; I can't wait. I should use it pretty plentifully, and shouldn't want to wait very long in making it bear a crop. Then I should find something to grow on it that would be better than corn and potatoes, or, better still, find better land to put it on. The difficulty is, the land was so near worthless. Nobody can take land, the lowest land in the world, and get money out of it till he works a long time. He must find something that sells for more than potatoes. There is but very little land so poor as that in the State of Rhode Island, but it is cultivated. Most of the land is far better, and with the same experiment would produce double what that did. They could not pick out on the State Farm so poor a piece as that piece of soil—nothing but poverty grass on it. If there was no better land on the State Farm than that, they had better sell out; but they have got better land, far better than that represents.

Adjourned.

SEVENTH LECTURE.

The seventh meeting of the series was held Thursday, March 4, 1886, at 2 P. M.

The meeting was called to order by Secretary Smith, who said: We are very glad to note so much interest in the subject of the afternoon as to draw an audience more than filling the hall. Our meeting next Thursday will be addressed by Mr. E. F. Bowditch, of Framingham, Mass., on "The Breeding and Rearing of Cattle." Mr. Bowditch will be very pleasantly remembered by this audience. He visited us two years ago and spoke on a similar subject. We have with us to-day a gentleman well known to most of you, whom I will call upon to preside at this meeting. He is secretary of one of our most successful agricultural societies in New England,—Mr. John G. Clarke.

MR. CLARKE. I am very glad to meet so many farmers and am very glad to be present and preside at this meeting. A few years ago it seemed as if our Domestic Society was on the verge of dissolution, but new life has been infused into it, and I think the present officers are entitled to a great deal of credit for their persistence and ability, and particularly for these meetings. These meetings are a success. The speakers have been interesting and the addresses valuable. I know something about the work of managing and organizing a society. It affords me pleasure to say that your speaker to-day is a gentleman of national reputation, is

a breeder and judge of poultry. It affords me pleasure to introduce Mr. Felch, of Natick, Mass.

MR. FELCH'S ADDRESS.

Mr. President and Gentlemen: I have accepted your invitation to address you upon the subject of poultry to-day, not expecting to tell you much that is new upon the subject, but that I might meet again, perhaps, some of the poultry fanciers I used to meet in days that have passed. It was my lot to speak for the second time in my life on this subject before the R. I. Poultry Society in this city, and I hope the meeting will result in a lively and general discussion of this great question. I have selected as a title or text for the occasion: "Corn, Telegraphy, Gold, Business, Poultry and Eggs." While the former has for years engrossed the attention and homage of the moneyed men —and, in fact, the whole world,—yet the latter has at last gained the respect of capital; gained the position of one of the largest of agricultural industries, and poultry culture has become fashionable as well as profitable, and even our ex-Presidents turn from the harrassments of public life to find pleasure and profit in its pursuit.

Our forefathers, as they saw for the first time the "maize," the Indians' greatest, and almost their only, agricultural product, little dreamed that in 1885 the crops of the new world would be measured by many hundred millions of bushels.

In our own day we have been surprised at the changes wrought by the telegraph and telephone, and all, both old and young, have looked with covetous interest upon the immense yields of gold and silver that are being taken from our mines.

Large as these interests are and important to our nation's welfare, yet the nation could suffer the utter annihilation of all three of these large interests with far less discomfiture to her sixty-five millions of people than to have swept from our land this poultry and egg product and industry we have met to-day to consider.

Does this assertion thrill anyone with surprise and doubt that it is true?

To destroy the corn the fifth quarter of our beef cattle would weigh less. The clear, fat pork would be less thick, but far better. The hump-backed and falling abdomens seen upon our poultry far less in number. Less whiskey, and less lazy, over-fat men, all of which we could dispense with, with profit. Fat or whiskey makes not one drop of blood or add one fibre to our muscles. Fat in excess is disease, and a favorable condition for Bright's disease, that scourge of mankind.

The telegraph and the telephone have filled the nation with feverish haste, forcing the work of fifty years into the space of a generation; increasing the death rate of the thinking, active part of our community, until to-day we cannot claim the length of a generation by at least three years that it was before their invention.

Our merchants wait until the moment they need their goods to order by telegraph, and by the use of the telephone trace and hasten them through with extra dispatch.

The manufacturer, catching the fever of haste by the use of machinery and merciless pressure upon the labor employed, produces the goods in the shortest possible time.

We no longer look upon steam travel as a medium of news with complacency. But each morning before we can settle ourselves to a social and quiet breakfast, we have to digest in the telegraph columns the armies, politics and price current of a world. Haste and greed of gain are shortening our lives and robbing us of the councils found in mature old age.

It has been demonstrated, in the legal tender notes, that gold and silver are no longer a necessity, and that paper may by the seal of a nation become its circulating medium.

As the Mayflower touched on Plymouth Rock, she landed a meagre coop of fowls, which, like the "maize" of the aborigines, has increased until the year just closed presents a product of over six hundred millions of dollars.

It is making a low estimate when we say three-fifths of the sixty millions of people under our flag will drink to-morrow morning coffee

made palatable and nourishing by the use of eggs; two-fifths at least of this great throng will eat their breakfast in part or wholly of eggs; fully half of the inhabitants will partake of a dinner, the make-up of which has involved the use of eggs, and their meat supply will be poultry; and more than one-half of the inhabitants will eat for supper eggs in some form—tea cake, custard, squash, or pumpkin pie. Many a suffering soul will have a leg amputated, tooth extracted, or other surgical operation performed under the influence of ether extracted from eggs. Many a fever patient, and those suffering from diphtheria, are being nursed back to life by eggs in their multitude of forms administered. The catalogue could be increased, but it is long enough to demonstrate the fact that we cannot exchange the benefits of poultry culture for the corn crop, or the benefits of the telephone, the telegraph, or gold, or all combined. The bankers, the merchants and politicians have their conventions, all sectional and selfish in their deliberations, and they are proud of them. Then why should we be less proud or earnest in our own. For one, I am proud to be numbered as a poultry crank.

We meet to-day to discuss ways and means to make this great industry of our land of still greater importance. We meet to compare notes as to relative difference in and the improvement of breeds; to consider the best methods in feeding, managing and marketing; the best houses and yards for poultry uses, and to arouse the farmers of New England to the consciousness of their neglect in times past, and to awaken an interest in this grand meat supply of the future.

To consider a few of the many breeds, the most profitable, and in doing so, pardon me if I place first on the list

LIGHT BRAHMAS,

And in sounding their praise can I do better than to say that forty-five of them kept for breeding last year $109\frac{11}{15}$ on an average when one year old and that in one year from the day the first pullet laid they had produced $602\frac{7}{12}$ dozen eggs, and ten of the forty-five had hatched and

raised a brood of chicks each, some of these setting upon eggs six weeks; and the whole forty-five Brahmas kept on the farm of H. F. Felch in one year have produced $602\frac{2}{12}$ dozens of eggs, being in excess of $13\frac{1}{3}$ dozens per capita, 160 eggs each. Can you blame me, one year ago for saying, "I believe and know them to be the best breed on earth, when they are bred to compact, close feathered forms"? They make as large broilers at nine weeks as other breeds do at twelve, and give the largest number of pounds for food consumed at the age of eight months, the most profitable time to kill them for roasters.

The late hatch will pay a better profit for winter feeding, and in March demand a higher price for heavy weight poultry than any other breed. As winter layers, all experienced poulterers award them the meed of praise as being the best, and no eggs rule as high in price. Their large size and dark shells have commended them to all, and their excellence the prime cause of the furore for dark shelled eggs. We hear of fraudulent poulterers who are coloring their eggs to palm their spurious stocks off as Brahma. Merit and value are the things counterfeited, and the fact that this coloring is being done is one of the greatest evidences of their true merit. But, thank God, as yet they have not found a dye but boils out when the eggs are cooked.

That you may not say that none but the Felch Brothers could get such a yield of eggs, I quote from a letter received from Asa Woodbury, of Lanesville, Mass., viz.: "Mr. Felch,—I have forwarded to you my year's experience with my forty-six Brahma hens. They have laid eggs during the year as follows: January, 753; February, 660; March, 983; April, 742; May, 603; June, 704; July, 626; August, 512; September, 426; October, 296; November, 258; December, 847; total, 7,410,—an average, as you see, of $161\frac{4}{46}$ eggs, thus beating the Felches in the egg product." He continues his account by saying:

"The eggs in my town have averaged 27 cts. the past year,	
and my crop of eggs comes to..........................	$162 74
I have killed 48 cocks, for which I received...............	53 76
Ten cockerels on hand actually worth.....................	12 00

Sold a lot of old hens for	11 00
Fifty-two pullets on hand in excess of last year	78 00
Total receipts and stock on hand	$317 50
Paid out for grain, etc	94 48
	$223 02

This makes a profit of $4.84 per head, and I start the new year with 108 fowls."

Gentlemen, have I not made out a good case for the light Brahmas? It is no more than can be done each and every year with care. It is useless to state cases where the fowls take care of themselves.

Just one word more for the Brahmas. Please notice in this statement that in December, January, February and March, the four coldest months in the year, they laid 3,343 eggs, which is a trifle over five-twelfths of the yearly product, and taking in November and April—thus taking six coldest months of the year—and we have over seven-twelfths of the year's product; and when we take into consideration the much higher price in that portion of the year, we do not hesitate to say no breed does as well or will pay a better profit.

THE DARK BRAHMAS

Have fallen into disfavor. Why, is a mystery. I can attribute it to no reason beyond the fact that as exhibition stock they are exceedingly hard to breed up to 92 or more points of excellence owing to the requisite pencilling demanded in a first-class specimen. The position only proves that beauty must accompany excellence for practical uses in a large degree. But to discard dark Brahmas on the ground that they are not good layers is not founded in fact. There is no doubt that the dark Brahmas were the result of the brood of chicks sent to England by Mr. Burnham from a Chitagong cock (or gray Shanghae, as he called them,) mated to the marsh fowl of that day—and from which the English fanciers perfected the partridge Cochin and by the

light Bramah cross produced the dark Brahmas sent to us in 1865. The demand for these birds was surprising when first put upon our market. The fact of sending half-breeds to our English cousins to pay for them on their return to us as thoroughbreds, may not be flattering to our vanity—yet the fact is to be acknowledged, however; and had there been the same interest in the nation in poultry exhibits to-day, there would have been a craze for them as is now shown for newly admitted birds to the standard.

The present style of pencilling in lines conforming to outline of the feather has caused them to be much admired, but much harder to breed. This has in the past few years seemed to take the courage out of many breeders, and they have one by one dropped out of the ranks until but few are now breeding them with care. These birds have merit, and while of all the large breed I now prefer the light Brahmas, because I have become so identified with them, I believe they are harder pushed by the darks than any other Asiatic; and I do not blame those who admire them for claiming equal merit for their pets. I believe the present revival of favor for them will again bring them into prominence, and that this second wind—to use a sporting phrase—will enable them to stay in the race for public favor. Their shorter pointed forms and slightly quicker growth should be appreciated, and in a measure make up for the slight difference in the size of their eggs which they suffer in comparison with those of their light ancestry.

The Plymouth Rock has had the best reputation thus far of all the middle-sized breeds, its greatest merit being its use for broilers. It is a fair producer of eggs, and, with good care, in small flocks, will produce 132 eggs a year—in large establishments nine dozen per year, the number set down by the majority of breeders,—the greatest drawback to the breed being the death-rate among the laying stock; yet, for all this, they have a large number of admirers, and a large number are raised: and he who would speak in wholesale condemnation of them deserves to be censured. Their merits far outweigh their defects, making them the second for merit, in my estimation, of all the gallinaceous breeds.

The Wyandottes are yet in their transition period. Sixty per cent. is all that can be said that they will breed chickens to score 85 points or more. Like the Plymouth Rock, they are of a cross-breed origin; like them, susceptible to disease far beyond that of the Asiatics. Yet we are still of the belief that they are destined in time to rival the Plymouth Rocks, for their skin is far more yellow, their bodies more plump, and they carry far more breast meat, which is appreciated in a broiler. It is hoped by their breeders that their laying qualities will be improved, and a larger number and a larger sized egg than their blue cousins lay. But he who says to-day that they are a better and more profitable breed than the Plymouth Rocks states an untruth. One may state that, in his opinion, he believes they are to eventually excel the Plymouth Rock, and time may prove him a prophet.

The perfecters of the Plymouth Rock remember the transition period of that breed from its cross-bred and mongrel condition, with its black chickens, its black legs, and legs feathered—the brassy and red plumage on huckle and saddle, and many times they were on the point of giving them up, with their "curses on the mongrel race."

We remember well a letter received, saying: "Felch, what are we going to do with these Plymouth Rocks?" It is marvellous, the call there is for them; yet one gets his stock just when he is ready to exclaim "Eureka!" when it is a hop-skip-and-a-jump, and the whole business has gone to the devil. Yet the breed came out of all this to be established as the second, and by its particular friends declared the best of all. To-day one can sell eggs from light Brahmas and Plymouth Rocks with a reasonable expectation of pleasing one's customers.

But in Wyandottes we cannot. Like the Plymouth Rocks in the past, they are now trying the breeder's patience. If he has sold eggs the past season, he has received many a letter he had rather not. Let him be ever so experienced a mater, all of his hens have not proved prime breeders; and some of his hens, from which he had expected only fair returns, have surprised him by producing for him his winners. To you who have bought eggs the past season, I wish to say: Have charity towards the breeder of whom you purchased them. He has

sent you eggs, in all probability, from hens he could have sold so as to have made a profit over her raising greater than you have paid him in cash for the three settings she lay him during the season in which they are generally purchased. If the three settings you bought have given you as few as four or six good breeding birds, you have no cause to grumble or advertise the seller as a fraud. But the day will come (and that speedily) when they will produce their quota of 90 per cent. to score 85 or more points, when all interested will rejoice and exclaim that the work to perfect them has paid. You weak ones who are inclined to exclaim in unflattering terms, hold your peace yet a little longer. Even in their crude state of plumage they have underneath it a profitable carcass for the poulterer's use—and this, with its appreciation as a show specimen, must even now place it as third in the list of practical stocks.

White Wyandottes and Plymouth Rocks are now asking admission to the standard, and may, perhaps, be considered by us with favor. There is a curious fact in color breeding that all Albinos, whether they be from the Black Spanish, the Black and Spangled Hamburg, Black Cochin or black birds of any breed, be they pigeons or fowls—if these birds be mated they ever after breed only white progeny. Now, these Albinos are as much thoroughbred fowls, being the same, as their ancestors, and they can be bred by crosses from any other Albinos and no derangement in color the result. Therefore I see no reason why the American Poultry Association shall not at once accept the White Wyandottes and by so doing lay the foundation for one of the best of middle-size breeds of fowls.

All this Albino and White blood will in all probability find its way into White Wyandottes—they all being Albinos, all rose-combed and yellow-legged—the race or breed to be established being an Albino from a cross-bred race. The whole thing is consistent, and the breed once established will be strong in constitution, somewhat larger, and their eggs dark shelled and of good size, their white plumage making them more desirable for use as broilers, the best for farm and poulterers' stock.

The Albino Plymouth Rocks and the Albino from the black and mottled Javas will come together in establishing an Albino family of Rocks. These have already been established and bred for five years. Their eggs are larger and darker shelled than their sisters, and they are of equal value with the White Wyandottes.

These two prospective breeds will have no dark pin feathers in the poultry. They will not have to be inbred to secure color, as all the parti-colored breeds have been. All the subsequent Albinos from the colored races named became new blood crosses. They will therefore be sure of one of the largest booms in trade any solid colored breed has ever enjoyed, when they shall have been acknowledged. They have already converted the fraternity in their favor, and I bespeak for them a ready sale and acknowledgment before, by limitation, they can be accepted. Common sense is backing the effort to perfection, which is securing their success and appreciation. The opposers of these cannot cite the Pea-Comb Partridge Cochins as a parallel, and the mistake of admission has no weight in this case, for they were a result of a cross of the Dark Brahmas with the Single-Comb Partridge Cochin. Who ever heard of success attending the cross of two breeds that were themselves the result of cross breeding? They unavoidably, as in this case, dwindle out and are abandoned. The Pea-Comb Cochins have died a natural death.

This mistake led the American Poultry Association to be more careful in the admittance of the Rose-Comb Leghorns, compelling the breeder of them to compete with the single-comb variety; and my experience in the exhibition room only confirms the wisdom of that body in so doing—for the failure to establish a rose-comb on a Leghorn that can stand the disqualification demanded of a rose-comb in other breeds, is apparent to all. To accept any breed simply on the change of one characteristic of it is by no means sound policy. This race—being a cross of the Hamburg, whose comb is the largest rose-comb in proportion to their size, with the Leghorn, whose single comb is still larger in proportion to size of body — has caused disappoint-

ment to thousands who have purchased them, and chagrin for the founders of them, and a deserved failure to be appreciated by the fraternity.

Breeds become photographed on the minds of all, and any change that affects form only without change of color is seldom appreciated, and in nine cases out of ten retards rather than increases all interest in such breeds. Reduce the comb of a Plymouth Rock to a sharp, high front and sloping to the rear, making a point or spike-shaped comb and still retaining its single characteristic—will any one buy it, even though they be in quest of small-comb specimens? No; for they claim at once that it has marred the beauty of the specimen.

There have been crosses used on the Plymouth Rock to check the tendency to revert to the Black Java in the progeny. This has secured in the Rocks a lighter shade in the plumage and a smaller single comb, all of which has added beauty to the race. The breeding of these crosses back to the Plymouth Rock have subdued all the evil effects of feathered legs and bad color.

But some have mated the Pea-Comb species in an endeavor to establish a strain with Pea-Combs. Will they have a boom, you ask me? I answer, No! They have ten times the chance to sustain themselves as a type the Partridge Cochins had, but who will appreciate a Plymouth Rock with a pea-comb. They will go the way of the Pea-Comb Partridge Cochin—or gain but half an admission by being allowed to compete with the single-comb. Fence chickens, fence politicians, fence Christians seldom are appreciated; and for these reasons I recommend these Albino breeds, and advise you to reject the other if you would reap the greatest reward in cash for your labor in the culture of new breeds.

In looking back over the advent of new breeds, we find that all that have had a remarkable run have had from eight to twelve years of breeding in obscurity before coming to the front.

The Dark Brahmas and Partridge Cochins went to England in 1853 as a brood of cross-bred chicks. They were by the English perfected, and returned to us in 1865 to find willing purchasers at high figures.

The Leghorns were bred from 1852 to 1865 as Spanish, Italians, Sicilys and Mexicans before they got place and acknowledgment as Leghorns.

In 1865 I offered them at the club shows at Worcester as Leghorns, and had to enter them as Spanish. This I did under protest; and the year following (1866) was the first show on record in which they competed as Leghorns, and not until after such recognition did the breed become of special interest and demand high prices.

The Wyandottes, during the twelve years previous to their acknowledgement at Worcester in 1883, waded through a mongrel existence under the title of Seabright Cochins, Eurekas, Excelsiors, American Seabright and Hambletonians, before they obtained a staple position and a general demand for them, and a paying price secured.

These White Wyandottes and Albino Plymouth Rocks have been produced all along the period of the existence of the tar-heels, and they are as much thoroughbred.

Thus far we have considered what I believe to be the best of the non-incubating breeds, and we now turn our attention to the White Leghorn. While we cannot recommend it as a breed for poultry—not being large enough for broilers or roasters, for at an age fit for the latter they are too dry and tough—but as layers they produce the largest number in the year of all others of the fowl race. They produce their eggs in the spring and summer months when the breeds before mentioned are raising their chicks. The Leghorn, being a non-setter, thus becomes one of the best, by the use of which we may augment the number of eggs at this season, and enables us to keep up the supply for our regular trade in eggs. They become a necessary auxiliary in the complete stocking of a farm for poultry culture, and must be considered one of the gilt-edged breeds—and to my mind the only absolutely thoroughbred, the Adam and Eve of the whole Leghorn family. All the others will revert to white by inbreeding, and are constantly showing evils that point to their cross-bred origin.

Partridge Cochins are the most gorgeous attired in plumage of all the Cochin variety, and the lovers of a variegated plumage, rich in its

many shades of brown, red and black, will breed and adhere to them. They are good winter layers if not allowed to get too fat. We would not, because we speak in praise of certain breeds from a practical standpoint, be thought to have no word of praise for other breeds. But there are many breeders present, and to them we leave the task of considering the praise of the breeds of their choice with which they have had experience. One breeder cannot be expected to have the best experience with all the breeds.

I have chosen to speak of those I have considered from a purely utilitarian standpoint, leaving the breeding for beautiful plumage and exhibition excellence for other occasions. Yet it could be with profit considered here, for farmers no longer breed the horse that it may draw his plough and his harrow at a walk, but that he may have speed and action—for one such sells for several times that realized for one fit only for the plough. And in poultry we find a pair scoring ninety-three to ninety-five points of exhibition excellence selling for $25 to $100, while the modest specimen of the same breed sell for $1.50 each as a simple egg producer; and the farmer who scouts the idea of degrees of excellence in fowls can no longer be consistent and demand a greater price for his speedy colt. But you, of all others, have the facilities to produce not only the fowls for practical use, but to rear those that demand the higher price for exhibition purposes.

Let the breed of our choice be what it may, its care and its management is the question which decides if it be profitable or not.

If our stock is made to breed even in type and color; if the eggs be of a nice, even color; if he be noted as securing in his stock those that lay dark-shelled eggs, thus delivering his goods in a uniform manner; and, above all, he be straight and honest in the matter of dollars and cents, giving all full worth for all money received—such a poultryman is sure of success.

Before the farmers at Boston I gave the following formula for making excelsior meal: Twenty pounds of corn, fifteen pounds of oats, ten pounds of barley, ten pounds of wheat-bran, to be ground fine and well mixed. I asserted that its use in rearing chickens would give re-

sults of a pound extra weight in twelve weeks, and a twenty per cent. gain in the egg basket.

One writer in the *Fanciers' Gazette* says of it: "Of all the egg food offered at fifty cents per package, if they are worth the money, Mr. Felch has furnished us with one that is worth $10,000 to the fraternity. It is extra trouble to procure and feed it, but it pays."

Every dollar one receives, as a rule, is but the representative of labor done; and no experiment, if of value over another, involves a greater amount of labor or a complication of labor—not, it may be, so congenial to our taste. The finer any piece of mechanism, the greater worth in machinery, invariably demands more skilled labor to make its worth available; but it always pays.

In all farm enterprises, the profits come as the reward of labor performed.

VALUE OF A BUSHEL OF CORN.

The value of a bushel of corn expended in a variety of food will produce nine to eleven pounds of live poultry. As we take the pains to cook or feed raw the material, or to feed in the exact proportions, thus fitting the material to the wants of the fowls, the same is true of pork; yet poultry sells at twice the price in the market. Now wherein comes the labor for which this greater price is the recompense, viz.: greater care to give the stock warm, dry quarters? In being particular as to regularity of feeding, the plucking and preparing for market, and, taken all in all, one and one-half cents per pound will pay at fair wages the difference in actual time consumed over that in the case of pork.

I allude to this from seeing in a paper the assertion that poultry cost twice as much to produce as pork. I am inclined to think the reason of this smaller production of poultry is the dislike of the farmer to consider and act in the matter of what they consider small things.

To prepare a hog for the market involves, with most of our farmers, the expenditure of fifty cents to the local butcher, the fire and work of the ladies in the kitchen to heat the water, the farmer's and his son's

time for the forenoon. The pig will weigh an average of 275 pounds. This is a fair average, also, of the trouble to fit Mr. Porker for the market. Forty Brahma cockerels, in November, will dress an equal weight. Suppose the people that have stood round to help in the killing of the pig had turned to pick the forty chickens, would the time consumed in the work been much, if any, longer? Is not the "*fuss with chickens*," as the farmer expresses it, one of imagination, and does it not cease to be *fuss and feathers* the moment we make honest work of it? Then as extra labor pays, and that it is our labor that brings the cash, we should ever be upon the lookout for the care of every minute detail of the business, and not consider it time lost that we expend in attending to the small things, and to feed with regularity and adaptation as to season.

WATCH THE BROOD.

Watch the brood of chickens as they leave the coop at peep o' day, leave the food left over from the night before to deploy in a skirmish line to the fields to secure the worms that lay upon the surface, and the insects that are lying dormant from the chilling effects of the dew and night air. Watch the grown fowls as they devour greedily the soft food, when the feed boxes of corn and oats have been open for them all the morning. Again at night see them leave the soft food to partake of the corn and wheat and to graze upon the grass before retiring, and learn thereby to feed in keeping with nature's teachings—to wit:

Chop fine, hard boiled eggs, shell and all, for the first feed for chickens, follow with baked excelsior meal cake crumbled into scalded milk for the soft food in the early part of the day, and canary seed, millet and granulated corn for the afternoon till two weeks old, when the excelsior meal may have ten per cent. added of ground scraps, the whole mixed in the scalding water, and when cool fed as the soft food for the morning, and cracked corn, oats and wheat making up the balance of the day. For the laying fowls, if confined, the scalded feed above mentioned, which may be made by mashing with the same, cooked vegetables, like potatoes, beets and turnips. The noon feed,

if in winter, some part of it should be steamed clover cut fine, with the afternoon feed consisting of corn and oats, barley or wheat, the corn being mixed with the other grains—corn being too fattening to be fed wholly, if a large production of eggs is desired.

You will find the time well spent to take your corn to the mill and exchange it for oats and barley or buckwheat, if you have not raised it, that your fowls may have a variety of grain food, and this care gives a greater dividend from your poultry house bank. The housing of your stock in winter is of the greatest importance. Health and vigor the keynote to that musical braggadocio which heralds the egg produced.

THE "POULTRY HOUSE."

For winter use, each house should consist of a laying and roosting room, which should be made wind tight, with proper ventilation from the bottom near the floor, and similar ventilation at the top to take off the dampness that in some weathers collects, giving the house a chilly condition; also an open shed attached to the same, that the stock may secure exercise in the open air each day, yet be protected from the winds and rough weather.

The houses recommended in "My Poultry Culture" are to my mind the best. They can be converted, one-half of them, into an open shed at will. This enables one to secure, during the warm hours of the day in winter, an open run for the fowls with less trouble than the shovelling of snow from in front of our poultry houses. This care will secure twenty per cent. more eggs, a larger percentage of them will hatch, a larger percentage of those which hatch will live to grow up and be better producers.

The large call for eggs for use in incubators has become an item for the poultry-man to consider. These eggs must be fertile—by the use of such houses, the use of medicated excelsior meal, or by the use of sulphur twice each week, or a smaller quantity each day in the soft food of the morning, but secure this. We predict that those who secure and hold this large trade for eggs will have to show to purchasers

that such quarters are furnished their stock. Those of you who are about building quarters for poultry will do well to consider this matter. One hundred hens, if they lay but ten eggs more each year, are giving you six per cent. on an outlay of four hundred dollars, and to secure this the extra expense to so build for their comfort will not exceed $20. When the brain works in company with our hand, there is always a greater profit.

THE PRODUCTION OF "BROILERS."

To make the production of broilers a business, the incubator becomes indispensable. But for all that, to say incubators up to this time have been successful, is not a fact, and the greatest drawback in their success has come from the manufacturers of them, in that they have sold to whoever would buy, without regard to the purchaser's conveniences or ability to run them. They have asserted that any woman or child could run them. As the result of such want of suitable contrivances to care for the chicks when hatched, and want of experience in the operator, four-fifths of them have failed, and to-day there are hundreds of incubators abandoned and stowed away among the rubbish of unused machinery.

To run an incubator successfully the operator must become master of the machine. He or she must learn how to control the evaporation to secure the requisite amount of moisture; he must learn to run it with the lowest flame that will secure absolute control between ninety-eight and one hundred and three standard degrees of heat. If the machine constantly fluctuates to a degree far below or arises much above, the chickens hatch in a weak condition. If the machine reaches 115 degrees during incubation, the "death rate" will be from five to sixty per cent., as it varies in heat from 106 to 115.

INCUBATOR AND THE CHICKS.

The chicks, as they progress, will generate an additional heat from the twelfth to the twenty-first day of ten to twelve degrees; this necessitates a constant watchfulness of, and the regulation of, the

heat guage, that the best results may follow. We see and we hear this remark—Secure your machine at one hundred and two degrees, and set the guage by the proper adjustment of the thermostatic "bur," and all you have got to do is to fill your light and turn your eggs twice a day till the chickens hatch. Suppose the ventilating apparatus were large enough to secure the machine from running above one hundred and six degrees of heat during the increasing heat generated by the growing chick, the current of air would be so great as to exhaust the moisture, and a large percentage of dead chicks in the shell the result. Thorough control and understanding of the machine itself, the control of the evaporation, and also later security of it; the ever watchfulness of the increasing heat of the chicks themselves and careful turning of the eggs, secures the results in hatching, and so far this can be done with incubators as well as by the hens themselves, when the operator has become an expert. This but half accomplishes the work. Suitable houses and brooders for their care then come into requisition. A very large number of the would-be operators of incubators have given no care to this till the chicks have hatched. But every one should first, in an artificial way, care for a season's hatch produced by the hens, then by becoming master of the art of rearing them with brooders, they can purchase incubators with a fair prospect of success.

Thus far they have tried to raise too many in one flock. Brooders from one hundred and fifty to even five hundred have been in use; this is being abandoned, and fifty we find the largest number recommended to be reared together.

Houses so arranged as to be cut up into small rooms, five by twelve feet, with open runs, that the chicks may go into the open air each and every day, must be furnished, even if they are not out but five minutes. To try to raise them on the floor and wholly indoors is to fail. We again call your attention to a house found in "Poultry Culture," also the Triban brooder, as the best house and brooder now in use. By referring to the slips that have been distributed, you will see the manner of their construction. You can care for the chicks in flocks or

broods of twenty to fifty in each brooder, as you are willing to spend your time more or less in their care.

Had the manufacturers of incubators advocated this preparatory way for their incubators' use, the demand for them to-day would have been almost universal, and the assertion that to raise broilers in the old way in competition with incubators impossible, never true.

WOMEN AND POULTRY.

A woman who will give her time and attention to become an expert in the management of an incubator and the care of the chicks, securing them in a healthy growing condition to the age of eight weeks old, from this time on can secure a salary better than she can secure in any other calling, and at $600 to $1000 a year will be demanded and secured. This we offer as a prediction. We hope that the ladies of our acquaintance will read this subject up, and act in accordance with this suggestion. I am often written to, to secure such help. I wish I knew such experts to whom I could refer to with operators such as I have described, with conveniences necessary; then, and not till then, will artificial incubation and rearing of chickens become a success.

And, last of all, the grand requisite—Have you capital to invest? In all business, no capital, no business, is the rule. Chicken business is no exception. When we say that there is no agricultural industry that pays so well for the capital invested, we must not be understood that the business can be carried on with no capital.

But to you, my young man, on a farm, if you have $500 or more, you settle down on the old homestead, and commence the work of chicken culture, and work up the business, growing with it; and its limits will be the measure of your energy and business tact. Beef rules high; colossal fortunes are made in its production. Chicken meat costs no more to produce, and poultry rules in price with the best cuts of the beef—therefore the margins in it are far greater.

The country is increasing in population: and other causes increase the demand for poultry meat. Every year the supply of wild meat and game is growing less. Wild ducks are less in numbers. The

game laws keep them out of the market a large share of the year. This want is being supplied by an increased production of tame birds. The season for broilers closes, so far as the hatching is concerned, at the time our tame ducks commence to lay. This gives the incubator-man three months more time to run them, and the duck hatched from March 1st to July 1st finds a ready sale at the seaside resorts, at a price equal to broilers. They grow in ten weeks to weigh from seven to even ten pounds to the pair. Seldom, if any, die; they can be kept in grass enclosures and fed four to five times a day with bread and corn meal, with ten per cent. ground scraps, and allowed to graze, to produce this most prodigious growth. They must not have water to swim in. Supply the water in fountains. I would feed them in shallow, galvanized iron pans. Pour a little water into the pan when you put the feed into it, for they enjoy their food in a sloppy condition. For the two weeks previous to killing, allow them chopped celery tops, and a flavor is imparted that deceives many an epicure into the belief that he is dining off the wild celery-fed mallards of Roanoke.

POULTRY CULTURE.

In going into poultry culture, do not, like many who go to a poultry show, become excited, and go home to pay a hundred dollars for a trio of chickens, and think your fortune made. But buy good, reliable, breeding stock—buying, say, ten females and a male, well-mated for breeding purposes, paying from $40 to $50 for the pen. Go to work in a sensible way, expecting to sell three-fourths of all your birds the first year or two, for practical uses—the males for broilers, keeping the females as egg producers till sixteen months old, forcing them into that production by a generous diet. When commencing to moult, kill them, and fill their place with the young pullets to repeat the process—selling for breeding purposes at a fair price, $3 to $5 each, and when you cannot do this, kill them for the market. In this way you will need send none but the best out as thoroughbreds, and in a short time you will become known as a breeder of fine stocks, and your reputation commence to grow as a breeder of them, and an increased income the

result. Be not feverish, but persistent in effort, and the old home will become a paradise, and the poultry and egg producing give you more pleasure than you could find in any other calling, and for which, we think, you would not exchange it for the corn crops, telegraph stocks or gold.

After the reading of the essay, the following discussion took place :—

QUESTION. Mr. Chairman, I would like to ask a question or two. First, I would wish to say the consumers of eggs find there is quite a difference in the looks and the quality of eggs. From some eggs when broken open the yolk comes out plump and bright, of a deep orange color—others come out rather pale ; in some the yolk flattens out, and either by conceit or actual fact they do not relish so well. Now, is this fact owing to some broods of fowls or the feeding ? Is there anything known that can determine the quality of the egg by breeding or feeding ?

MR. FELCH. Well, there is no doubt but what the feeding has much to do with eggs of any breed, but the albumen of the Asiatic egg has much more consistency. It will be found that five will make as much custard of the same consistency as will eight of the Leghorns ; yet your good wives will tell you that one of those large dark-shelled eggs comes out in nice, globular shape, while a Leghorn is more likely to run and flatten out. Now, an egg will vary in color as the fowls may be shut up from roaming about. Those that have a free range will probably have the largest, darkest-colored yolk. Meat will give the same color, while if you shut them up and feed them on cabbages and barley and oats—no corn or meal—the yolks will be almost straw color, about the color of the grain they feed upon. There is certainly a difference ; and I think any one used to it can tell a Brahma from a Leghorn egg, and after noticing the difference once or twice, I think you could tell blindfold.

QUESTION. Then it follows that in producing eggs it is well to look after the quality, because consumers are getting more discriminating in that way than they used to be.

MR. FELCH. Certainly—all the time worth looking after. Large dark-shelled eggs bring ten cents a dozen more. People ride out a mile and a half to get our large Brahma eggs and pay ten cents a dozen more. My brother went into the store the other day to get his paper and he noticed rather small-looking eggs in the basket, and he said it ought to be a state prison offence to sell those eggs; and he carried down a dozen Brahma eggs just as they were laid, and they weighed 2 lbs. 2 oz., while the others weighed 1 lb. 2 oz. There will probably be as a rule about 9 oz. difference between them on a fair average,—Light Brahma and Langshan probably. Well, next would come a breed of Cochins and Dark Brahma. The Cochin will lay a small egg with a thicker shell. The old-fashioned Black Spanish used to lay an egg about as large as any laid. They have decreased with the breeding of fine points in the shape and pencilling of the feathers. The Leghorns probably come next, the Hamburgs next, and from them down to Bantams, in size. It is certainly a question that ought to be agitated that eggs should be sold by the pound just as much as the fowl, if a person is going to get a fair price for what he has to sell. It is rather amusing, sometimes. I know a man in Westboro who has got a large ranche, and he said he spent all of one week trying to find something to color his eggs, but he said he couldn't get anything that would affect the egg unless it would boil out, and he says, "I tell you what I will do; I will get a board with holes in it and eggs that will go through those holes,—I will swap at the store, while the others I will send to Boston." He went away to attend a case in court, and when he got home he saw a box of eggs at the depot returned to him, and the note said, "We don't want any more pigeon eggs." The man that had been taking care of

his stock had sent them right along in all sizes, and they did not give satisfaction. I don't want to countenance the fact that he cheated the local dealer for the sake of getting a better price in Boston. I think we ought to sell eggs by the pound.

QUESTION. How does the Plymouth Rock compare with the Brahma?

MR. FELCH. They are not so highly colored. I think the Wyandottes are more apt to be dark-shelled than the Plymouth Rock. As for size, the Wyandottes and Plymouth Rocks will be found to be about the same. The average size Plymouth Rock will weigh about $1\frac{3}{4}$ lbs. to the dozen—four or five ounces difference between them.

MR. HOPKINS. A farmer keeping a hundred hens should devote how much grass land to them?

MR. FELCH. Well, if you have got a small amount of land, make two yards of it so that you can sow one down with oats while they are eating out of the other yard. You can keep 100 hens on a very small amount of land in this way—one-sixth of an acre in two yards, if you see to it that these two yards are alternately sowed down; but when people get small yards they are apt, you know, to let the thing go a few days, and the first thing they know their hens have been a whole month without any grass, and it is essential to the best condition of the hens that they have grass very free—if you have a yard large enough to keep them in grass without constantly cultivating. I suppose you could keep about 400 to the acre, if in the spring time you would be a little careful to let your grass get started before you let the fowls run.

QUESTION. It seems to me that farmers cannot afford to keep hens in the ordinary manner if they allow them to run upon their meadows and pastures. They will destroy more grass in that way by constantly pecking at it while it is young and fresh, than it would cost to feed them in good yards, as you suggest, by sowing occasionally grass, oats or rye.

Mr. Felch. Well, as to that, I think that if I had one hundred turkeys running over my grass land I should expect to get more grass than ever. A turkey won't trample it down much, and I think the grass will be better. Now, I recollect at home one year I raised four hundred chickens alongside of a potato field. Of course the hens would get out—I would let them ; and they scratched up a hill now and then. Father seemed to think I had better shut up the hens, and I told him I would pay him for the potatoes at the rate of sixteen hills to a bushel for all they dug up, but I would like to have them run. When he came to dig them, he dug right in front of the coops, for a certain distance, right out into the field at the rate of nine hills to a bushel. It looked to me just as if the chickens helped him out. They will help out a grass lot in the same way. Of course, right around the vicinity of your house they would eat it up ; but I think a man is "penny-wise and pound-foolish" when he goes to figure the amount of damage the chickens do. I wouldn't make a fence ; I would build my houses all over the farm, here and there. I wouldn't raise but fifty chickens in a coop, and I would have enough better chickens to pay for all the trouble. The land would be made better by their occupancy of the land than from any other stock.

Question. I would like to ask the gentleman one question. I have been informed, and I have practised it for many years, that a good egg is always warm on the big end. When I go to pick out a dozen eggs in the dark I always try them, and if I find one that is cold I never take it ; I know it is rotten.

Mr. Felch. Well, I have learned something I didn't know before. When I put my hand in under a hen that is setting I always take out those that feel cold, for I know they are dead. The ones going along properly are warm. Of course we know it must be so from the fact that they are warm at the large end.

Question. You will find in the large end a cavity, I believe.

In picking out eggs I just try them that way and always find them fresh.

Mr. Felch. Well, there is reason in that when the egg is just laid ; but after a certain date, when the egg has become cold, I don't think my friend can tell. It will be warmer than the other part of the egg because of the cavity. The air will make it warmer than the balance of the egg, which has a cold liquid lying there.

Question. I have always considered there might be a little electricity in there to help the egg along. I don't know how it can be explained. I know I never missed myself getting good eggs.

Mr. Felch. Speaking of electricity gives me another thought with regard to feeding sulphur. A hen that is confined closely all winter and has laid more or less, thc sulphur in the system becomes exhausted, and thus the egg will not hatch. This is the prime cause of all the trouble we hear about eggs hatching in the early spring. When they have free range they will re-stock their systems with sulphur. The eggs don't hatch ; they don't know what the trouble is. That is the sole trouble. If you will take the pains to feed sulphur in the proportion of a dessert-spoonful twice a week through the entire winter and give them open air exercise, I don't think you will have any trouble with your eggs hatching any time of the year.

Question. If eggs were sold by the pound, the tendency would be to increase the size of the eggs ?

Mr. Felch. Well, I think you would get a larger price for your eggs—a larger money value for your yearly product. A great many men breed a small size, perhaps thinking that an egg is an egg. Now, a hen that lays the greatest weight of eggs will always eat the most, no matter what the breed is. Take a Light Brahma that isn't laying and a White Leghorn that is laying, and you will find the Leghorn eats the most. A man came to me and said :

"My White Leghorns eat more than my Brahmas; do you suppose it is the blood it takes to keep those combs along?" I said: "My friend, I guess your White Leghorns are laying the most eggs." "Yes," he says, "they are laying the best now, the others are not laying at all." So you will find it always—the hen laying the most will eat the most. You may be sure that you are getting either meat or eggs.

MR. SMITH. Mr. Felch, I am requested to ask your opinion of the Java and the American Dominique fowls.

MR. FELCH. The American Dominique, as it is called, they have been trying to improve a little by the introduction of Dark Brahma and Plymouth Rock blood. It seems useless from the fact that the Plymouth Rocks are better and more desirable as poultry, and they lay more and larger eggs. Now, the Dark Brahma is nothing more or less than a dark Plymouth Rock, and the White Brahma is the same as the White Plymouth Rock. They are all the same blood, and the crosses that made the Plymouth Rock were our White Brahma bred to our old-fashioned Black Java. It was an India fowl with feathered legs and half old-fashioned Dominique to secure the color. Now the reverse in this cross: we went back for the black color to the Black Java, and they got into the standard as a breed. The Javas to-day are simply Plymouth Rock blood. It has been bred or made over into Plymouth Rocks, and their tendency to breed back was so strong as to give them the color of their paternal ancestor. The White Plymouth Rock and the Black Plymouth Rock and the Light and Dark Brahma are all the same thing.

QUESTION. I would like to ask Mr. Felch what kind of business, especially the poultry business, he carries on, and the amount of it in the course of a year. How much business do you do?

MR. FELCH. In a practical way I do very little. My business is carried on by hiring farmers to raise my thoroughbreds. I pay

them a certain price for every dozen birds raised and take from their farms a certain price for every dozen eggs raised, and take from the price the growing, breeding, etc. They have no privilege of selling the stock, only the hens not mated. The first of March all the birds that I condemn for practical purposes they kill, and take whatever they can get for them. I don't care to do that business, so that mine is not a criterion to speak of in the connection I have spoken of this afternoon for practical usage.

QUESTION. Then your business is what is called fancy breeding, —all thoroughbreds at thoroughbred prices?

MR. FELCH. Yes, I breed everything thoroughbred, and I advocate it for practical purposes, for I know they lay better eggs and I think they are a little better to eat, too. I know that some farmers get very good incomes, as I have read of one or two from papers here to-day what they have got on a practical basis. Everything has been based on my thoroughbreds, but in a practical way, taking what they are worth for practical purposes.

QUESTION. I would like to inquire how these farmers raise the chickens—by artificial means or hens?

MR. FELCH. I never raise them by artificial means. I know that a thoroughbred cannot be raised to score as many points as by the old way, and, of course, that is the most value to me. A bird that will score 90 points will bring $20; one that will score 95 will bring $25. Every bird that I can get over 92 will sell at a large price, while one that fails to reach that will sell at a nominal price. When you come to breeding for broilers, in some seasons we have got to use the incubator or else our business would be a very small one.

QUESTION. What do you think is the most successful way of hatching chickens from the eggs?

MR. FELCH. Now, at this time of year I should use the chaff of the barn, with very little hay indeed. Some people take a large

box or fill a barrel partly full of hay, and make a nest and set the fowl. Now it comes cold weather, and the cold reaches underneath through the straw and chills and kills the chicks in the eggs. Many a disaster follows; when, if you used a little of the chaff that is small, it would keep the air from reaching underneath and you would have the best of success. Another way, a little later, is to set them on the ground. Take a box and get a sod for the bottom of the box; turn the sod full of water and put in very little hay. The heat of the hen will dry the moisture enough to secure you a perfect hatch and a more healthy one. Some seasons of the year they will hatch most anywhere in the sun.

QUESTION. What causes red specks in eggs?

MR. FELCH. The red specks are caused by some injury. A little strain or something causes blood to settle in the overduct which gets into the egg with the albumen; or the rupture of some small blood-vessel would cause it.

MR. ANGELL. I want to say for the information of some that about twenty-five years ago I made an egg rack and placed in it about twelve dozen fresh-laid eggs, and we found them just as fresh in the spring. It had a shelf and then a slide that went in on the top. It turned the egg from one side to the other and from one end to the other, and that kept the yolk in the centre; and my experience has been that as long as you keep the yolk in the centre where it belongs, you have got a good egg. I brought that egg in for you to try.

MR. FELCH. Well, the old gentleman is right—that is a good egg. I would keep them for incubator purposes in flour about one-third of the distance up. You needn't move them for thirty days. They will keep for three months set in flour to keep air from the large end of the egg, through which the egg is ventilated during the whole of the time of its incubation. It is just simply in a shelf of flour deep enough so they set right down in it. They will keep much longer fresh."

QUESTION. How cold will it do to let them be?

MR. FELCH. Well, an ordinary cellar would be cold enough. Of course, if you keep them for kitchen use, to keep them just as long as possible there are the cold storage houses, where you can keep them any length of time.

QUESTION. I mean for incubation, especially through the winter?

MR. FELCH. Why, any cool—any naturally cool place, like an ordinarily dry cellar?

QUESTION. At 50 degrees?

MR. FELCH. Yes, cool enough. House cellars will probably be cooler than that—from 35 to 40 degrees. I do not think it will hurt (any cooler weather) unless it comes cold enough to granulate the egg and cause it not to hatch. An egg will stand more and colder weather than you think. I had a little bantam hen that made a nest in the barn cellar and laid eleven eggs and hatched nine of them. Some of the time she was laying these eggs it was fearfully cold. You can put a pitcher in a box; it may freeze all around the room, but the pitcher will not freeze in the box,—so an egg will stand a temperature where water would freeze and not be affected by it.

QUESTION. How long can you keep an egg and have it incubate?

MR. FELCH. As I was saying, they will hatch three weeks old kept in this way. I presume you could keep them six weeks; but never, in shipping eggs, should they be shipped over ten days old. They may be kept six weeks and set and hatched well. But you cannot keep over two weeks and ship them on railroad trains and have them hatch. If they are kept quiet they will hatch at the end of six weeks; but an egg set soon after laying would be altogether better. You know a hen steals a nest and lays many eggs—sometimes fourteen or fifteen. She sits long enough to

warm the whole of these eggs, herself keeping up the vitality of the eggs. In such a case nearly all the eggs will hatch. When you have taken these eggs, there may be several hours' difference in the hatching of them, and the one laid last will hatch first.

QUESTION. How far can eggs travel and be hatched safely?

MR. FELCH. I don't know. They bring them from England here. I send them to nearly every State and Territory in the Union, and have them hatch. I sent out to California thirty eggs to a gentleman, who reported twenty-seven hatched; while four or five hundred miles from here I sent at the same time the same kinds of eggs, and they wrote they wouldn't hatch at all. You can never tell. But then I didn't believe the last man at all.

MR. C. W. SMITH. Mr. Felch, a gentleman present, who ships eggs sometimes, shipped to Ohio thirteen eggs, of which every one hatched. At the same time, from the same lot of hens and laid at the same time, he shipped to Connecticut thirteen eggs as he did to Ohio, and his customer hatched only two chickens. The Connecticut man thought the dealer a fraud, while the Ohio man thought he was a man of judgment and honesty. We find this difficulty in shipping eggs. It is probable that less care was taken in one case than in the other.

MR. FELCH. Well, you can take a basket of eggs and set five hens on them, and perhaps three out of the five will be given eleven and hatch that number of chickens, while the others will not hatch an egg. There is not heat enough to cause an egg to germinate in the winter time. If the hen has not the fever heat—enough to throw the feathers from off her breast—you may be very sure she will not hatch your chickens. I just make sure those feathers are off when I set them. I don't say how, but they come off. In winter time, if you have a cellar kitchen that you can keep at 60 degrees of heat steady, you can hatch your eggs just as well as in the summer time, because it has no more than the sum-

mer temperature outside of it to overcome by the incubating fever. This is the grand reason why so many failed in the winter,—they set them in cold places, and none but a hen that has the incubating fever will hatch in the winter time.

QUESTION. I had eggs sent to me from Philadelphia last June, and I got them three days later. I examined those eggs and caused seven of them to be broken, and those seven eggs were rotten. That is why I asked the question how far they would travel.

MR. FELCH. Of course there is the same percentage of dishonest men in the chicken business, I suppose, as in all others, and they make mistakes in the time they have kept them; they think it is a shorter time than it really is. But in your case I think you got very stale eggs.

SECRETARY SMITH. Several persons interested in poultry have asked me to call a meeting of those interested, for the purpose of forming a State Poultry Association; and I would invite those interested to remain after this meeting is adjourned and talk the matter over.

EIGHTH LECTURE.

The eighth meeting of the course was held March 11, 1886, at 2 o'clock.

Secretary Smith called the meeting to order and announced that the next meeting would be upon "Poultry Culture," when Mr. Philander Williams, of Taunton, Mass., President of the American Poultry Association, and also Mr. H. A. Mansfield, of Waltham, Mass., a noted breeder of Dark Brahmas, would address the meeting. He then asked Mr. W. H. Hopkins to preside. Mr. Hopkins introduced Mr. E. F. Bowditch, of Framingham.

MR. BOWDITCH. Mr. President and Gentlemen :—Before I begin, I would like to say that the oftener I am interrupted by questions the better pleased I shall be. My subject will be "The Breeding and Rearing of Cattle."

MR. BOWDITCH'S ADDRESS.

Cattle have played a most important part in the welfare of mankind for many centuries ; in fact, it is stated, and I believe on good authority, that the cattle that came off the ark with Noah were beasts of burden ; their usefulness even in those days was known, and in many countries cattle have been and are to-day worshipped.

When we think of the many and varied uses that are made of cattle to-day, not only as beasts of burden, food and even clothing for man, certainly cattle-raising is one of the most important subjects for farmers to consider. With us at the East raising cattle for beef is at a

minimum, and few farmers, except in isolated cases and those who turn a few oxen or old cows for beef, give much thought to breeding for beef, but look forward in raising cattle to breed those which will produce the most milk and butter, and thus return the most ready money to the farm. There are so many different breeds, and each has so many advocates, that it would take too long to discuss the merits of any one of them fully; so in the short time I have to talk to you, I will only try to give a few practical ideas about breeding and raising cattle for our every-day use, for which purpose most of us keep cows.

All of us ought to raise enough young stock each year to take the place of the old cows, which have fulfilled their term of usefulness. In the first place, remember always that the bull is by far the most important animal in your herd, for if he is not of the right stamp and quality every calf bred in your herd will carry in its veins half of his blood and characteristics. Many breeders have learned to their sorrow that however handsome, attractive and well bred, according to herd books, a bull may be, if he is not well bred from a productive strain of blood, they made a sad mistake in using him, which costs much time and labor to eradicate.

It is said by many breeders that the offspring takes the outward look of the sire and the inward qualities of the dam; but, from a common sense standpoint, do not all of us feel surer of breeding what we want —and has not the result proved it to be right—when we breed a first-class cow to a bull whose dam was known to be a good cow and bred on both sides from animals of a like quality.

For this reason a pure-bred line should always be used, for the taint of mongrel blood will always show out even in the third or fourth cross. I do not mean to say that all pure-bred bulls are fit for breeding, but in any of our well-established breeds, bred for a certain purpose generation after generation, the regular habits or quality of the breed will be much more likely to assert itself than in any race of grades, unless bred long enough and intelligently enough to make a breed by themselves.

The cow from which to breed good stock should have a good sound

constitution, combined with good temper, and show points strongly marked, whether for milk or butter, as the requirements in the case may demand. A heifer, to be best and last profitably until nine or ten years old, should not be brought into milk before twenty-four to twenty-eight months old. Young animals, well grown and well fed, are as mature and as well able to begin their work at the above age as those brought up in the common country way, but half fed and poorly cared for, are at one year older. In the second place, a young cow not well cared for while young, never can be as large or have the constitution for work, and therefore never will produce as much in either milk or butter afterwards.

Cows that are fed high and forced to produce very large yields are not as good to breed from as those that are only well and generously fed. When we think for a moment that nature originally expected a cow to yield only enough to raise her calf for five or six months, and then dry off to save her strength for the next calf already growing within her, while now that she has been civilized and her standard raised to yearly products that would make our forefathers stand aghast if they were permitted to return and see some of the farmers' cows of to-day milked.

I do not believe a herd kept for breeding purposes should be fed more than is sufficient to keep them in good flesh and yielding a profitable return. In one way it may pay a breeder to force a few animals and make famous records, because, if successful, a boom for that especial family is created, and he may make very remunerative sales, even if he spoils some of the cows thus forced.

In preparing cows to drop their calves, I would suggest a few practical ideas which have been of great service to me in the last ten years. Formerly I used to have many cases of milk fever, and, as you all know, the best cows are much more liable to this trouble than poorer ones. I would advise that as soon as a cow is dry (which should be at least a month before calving, and, better still, six weeks), feeding old-process oil meal every day, beginning with a small quantity and gradually increasing the amount till you get up to two quarts per day, if your

cow is one of a large breed, and a little less if one of a small breed. It has a direct effect on the mucous membrane, enabling the cow to calve easier, and as oil meal acts directly on the bowels, it keeps them in the best possible condition all the time previous to calving. I administer immediately after the calf is born a dose of Epsom salts, with ginger or cayenne added, sometimes molasses also, varying in quantity from a pound and two ounces to a pound and twelve ounces, according to the age, size and condition of the animal. If the medicine does not operate in twelve or fourteen hours, give another dose, a little smaller, and if this last is not heard from in eight or ten hours more, aid the medicine with an injection of warm water.

Never let the afterbirth remain in a cow over twenty-four to thirty-six hours at the outside, but remove the same gently by hand. If you are very careful you can do it yourself. A half-brick is a very convenient thing; fasten it with a strong cord,—a steady weight will very often remove it in the course of five or six hours; but in case that fails to do it, the first thing to remember is that you must use no force. The little cotyledons that hang together bleed very freely if they are torn with any degree of violence. You want to go so far as to be sure your nails are not too sharp—that there is nothing likely to cut. Then with the left hand get hold of that portion which is visible outside. The whole of your right hand and arm pass in, guiding yourself by the string which you hold in your left hand, and when you come to these little bunches, separate them very carefully and slowly. Then it is a matter of time; do not use any force, but, keeping your left hand tight, work gradually, and you will find that gradually you work through. It is a mere question of time. If you have done one, why the only thing is to go through till you have got them all. I have removed a great many myself and had a great many removed in my barn and I have had no trouble with flooding or anything of that sort.

SENATOR OLNEY. Now, for instance, in that kind of trouble, I never had it fail when I have taken an ear of corn, (large size,) bored it and filled it with gunpowder and given it to the cow—(a

couple of these ears)—and it will be all over in twenty-four hours.

Mr. Bowditch. And yet in that same case you could not have told if you had not given that medicine but that nature would have taken care of it.

Senator Olney. It had gone several days before I administered it.

Mr. Bowditch. Well, nature sooner or later takes care of it. It is said to be a very good plan right after calving to give a dose of salts,—it has a very beneficial effect; and another thing that is suggested as very good is to blanket the cow very warmly after the calf is born, till the afterbirth comes away. If your cow is in first-rate condition it is all right. I have got perhaps thirty or forty bearing animals, and I think once in the last twelve months I have had to use the hand, that's all. It is rarely when the animal is in first-rate condition, and fed with oil meal, that nature doesn't do her work, and promptly, too.

Mr. Hopkins. It is very important that it should be done by a person familiar with it. I lost two valuable cows by a man who pretended to know what he was about.

Mr. Bowditch. Exactly; but if you take a man that doesn't pretend to know, but is willing to learn and having common sense, and if he works very slowly there is no great difficulty. If by any chance the cow has not gone her full time—

Mr. Hopkins. That was the case with one of mine.

Mr. Bowditch. If you are sure of that, you want to work with the more care.

Listener. I would like to inquire whether it would be proper to let the cow drink the first milk?

Mr. Bowditch. It doesn't do any harm; I very often do it. I always give a warm drink after the dose of salts—a couple of quarts of shorts with warm water.

Listener. I had a farmer who used to recommend the same

that this gentleman did—the powder—and after that to let her drink her milk, and rubbed her along her back. I had several cows, and he told me to let them have the first milk. I have done that since, and never met with any loss.

Mr. Bowditch. Not the least objection to it. I very often do it, though I don't think it is at all necessary.

Senator Olney. I never offered a cow her own milk. Will a cow drink her own milk ?

Mr. Bowditch. Another reason that the first milk is of great service is that it takes the place of a dose of salts. As you all know, it is very purgative in its effects.

Mr. Peckham, of Middletown. I would like to ask if you think it proper for the cow to eat her afterbirth ?

Mr. Bowditch. No, I do not. It is their instinct to do it, but inherited from their wild nature. Undoubtedly the reason of her eating it was to clean up all signs of the calf being born, so that they would not be tracked by wild animals. That seems to be the one reason as far as I can find out. But a great many people allow their cows to do it without any ill effect. But you will find occasionally the cow's stomach isn't able to digest it, and then you have a hard time getting it away. I have had two of those cases myself.

Mr. Brown. Sometimes there is danger of the cow's being choked.

Listener. I haven't had that trouble. It chokes them after they have swallowed it, sometimes.

Mr. Bowditch. I know, but the choking part is lower down. That has been my experience.

Listener. I have known of two or three cases where they did choke to death.

Listener. I know a man who lost the two best cows he had last season. They choked to death.

Mr. Bowditch then continued his address, as follows :—

In the matter of calving, nature always does her part of the work well and promptly, and any interference ahead of nature's plan does great harm. A valuable cow should be watched when due to calve, because, even if the presentation of the calf is natural, a very little human help at each labor pain saves the cow much time and consequently exhaustion.

We have now got the calf born into the world, and the question is how to raise it in the best and cheapest way. Most of us cannot afford to let the calf suck the cow; and, in fact, many of the cows of to-day give such a quantity of milk and it is so rich that the calf, if allowed to run with its dam, would begin to scour, and if allowed to remain with her would undoubtedly die. Few of us can afford to give new milk for many days unless the calf is a very valuable one, for either the milk must be sold or set for making butter. Take the calf away from its dam within twenty-four hours from the time it is dropped, tie it up, and you will be surprised to see how soon it becomes halter-broken and ceases to worry for its dam. Let it have a small portion of its mother's milk for a few days and then gradually add skim milk, always making sure to have it at 100 degrees in temperature. About this matter of temperature, do not guess at it or think your finger will tell you—nothing but a thermometer will do, and that costs so little that everyone can afford to have one. With care and judgment in changing from new to skim milk there ought to be but very little trouble.

After a calf is ten days or a fortnight old, begin to feed rowen or early cut hay, with a handful of grain, such as bruised oats, oil meal or bran, or a mixture of all three—a small handful is enough to begin with. If it is desired to keep the calf fat and plump, flax seed or oil meal gruel, strained, can be added to the skim milk. Other than this, it is better to feed the grain dry. One trouble in raising calves on the pail is their desire to suck everything within their reach, from a fist to their own tail. Much can be done to help this by putting a small handful of dry grain in their mouth the instant they stop drinking. The more slowly you can make the calf drink, and in this way make

the saliva mix with the milk at each swallow, the less desire will the calf have to suck. In other words, imitate nature and use any device which will oblige the calf to spend five minutes or more in taking its three or four quarts of milk. There are several patent arrangements that work very well, though they are not made quite well enough to last; but a very good thing is to take a small piece of hose pipe and put into the bottom of the pail, so the milk will come through slowly; or a strap to suck,—anything to make them eat slowly.

If by any chance too much of the first milk or too rich milk has been given the calf. and scouring commences, which cannot be checked by reducing the amount of milk with charcoal added, it is a good plan to give a small dose of castor oil, then feed the calf with small feeds of skim milk cooked either by steam or in boiling water, which should have all the scum (fat) carefully taken off, to which should be added in each feed one-half pint of lime water and a tablespoonful of willow charcoal, powdered. If skim milk is plenty, I would advise feeding it till the calf is seven or eight months old, besides a daily ration of early cut hay and grain, as before mentioned.

I find that calves born in autumn or early winter do the best, as they have made a good growth before the time comes to turn out in the spring, and they are at this time in condition to make a good growth on grass. I think it is better to keep calves in a small field of good grass, rather than turn them into large pastures, where they will eat all sorts of foul growth and twigs, which will do them much harm.

If the feed has been good and no accident happens, a calf so treated ought to be by the autumn a fine, thrifty animal, and ready to make a splendid growth during the winter. A small feed of grain can be given all through the season, which will do them much good. The feed at this time should consist of good hay with a little grain and a few roots if available. By good hay I mean good hay or its equivalent. I think if straw fodder and corn stalks are fed with the hay, and a trifle more grain added, that young stock do better than when obliged to eat the same kind of food all the time.

During the winter, besides good food, good water must not be for-

gotten, and every animal, whether young or old, should have the opportunity given it to drink twice a day. (Running water is much better than water pumped.) It is a remarkable fact that in my different yards—in two I have running water, in the other a pump—the same animals will drink fully double the amount of water as it comes running, although it is as cold as that we pump for them. I don't know why they do it, but they do it always.

Plenty of yard exercise should be given every decent day, and by yard exercise I want to emphasize against the abominable practice of running stock out in the fields in winter to get exercise, and thereby get a chance to fill themselves with frozen grass, and after eating it, the animal has no desire to eat its proper food when it has it offered to it in the barn.

Young stock thus treated will be mature enough at fifteen or sixteen months to be bred, and if the breeding has been judicious and the strains of blood good, the heifer when coming into milk ought to give nine or ten quarts of milk or make five or six pounds of butter per week with its first calf.

There are many troubles incident to breeding, such as not being able to get an animal with calf. One trouble is that the neck of the womb is closed so tightly that the service of the bull amounts to nothing. This trouble is very easily remedied by opening the neck of the womb when the animal is in season by introducing a finger, and immediately give the service of the bull.

The fault of non-breeding most generally rests with the female. Look to the condition of the animal, determine for yourself whether your heifer is in too high or too low condition, and feed accordingly. If in too high order, a dose of salts just before the period of heat is due to come on and bleeding at the time of service may be of use.

If there should be a discharge from the vagina most of the time, that shows some irritation of the womb, injections of warm carbolic acid solution should be given daily. If the discharge seems foul, a solution of sulphate of zinc, ten grains to the ounce, may be used instead of the carbolic acid.

Cows that have had calves and fail to get in calf again are the most difficult ones to deal with. If there seems to be no internal trouble, the best plan is to send them away quite a distance to get a change of air and pasture and allow a young bull to run continuously with them.

MR. BURLINGAME. Is it pure or diluted carbolic acid that you use?

MR. BOWDITCH. Oh, diluted,—the pure acid as near as you can get it; reduce by 100 parts of water.

MR. O. BROWN. Does the feeding of oil meal force the milk to any great extent.

MR. BOWDITCH. No, I never noticed it had that effect at all. The only way I can explain it is, I believe it an old country practice among the old ladies, if you have got a bad cold or any inflammation of the mucous membrane, flaxseed tea is considered one of the best drinks to give, and this oil meal seems to answer the same purpose and have the same effect—and the mucous membrane goes all the way inside.

MR. O. BROWN. You would not expect so much fever in the bag by feeding two quarts of oil meal as indian meal?

MR. BOWDITCH. I don't believe any amount of oil meal will ever produce fever. It is a fat-producing feed, of course, but the oil in it seems to counteract all heating tendencies. I know Mr. Sam. Thorne, who fed as much of it as any man in the country, used to say it was not only the best feed but the best medicine, and he fed it to animals of all ages. They may over-feed so as to produce scouring, bnt never anything like fever.

MR. O. BROWN. Is the new process meal similar to the old one or not?

MR. BOWDITCH. I know, occasionally, when I am out of my old process meal and have to take a bag or two of the other, my cattle don't like it as well, neither do I. The difference, as I understand it, between the old and the new is: In the old the oil is removed

almost entirely by pressure, and in the new process naphtha is used; and when it was first used, occasionally there would be some of the naphtha left in it, and I know in one instance several calves fed on it had a good deal of irritation of the lips as though there was something sort of irritating.

LISTENER.. I have heard of that trouble when people fed it to cows.

MR. BOWDITCH. You look at the meal itself; it is very dark, as though the good was all out of it, in one way. The old is very different—it is oily to the touch.

MR POTTER. You are speaking of oil meal—do you mean linseed or cottonseed?

MR. BOWDITCH. Linseed; I am very much afraid of cottonseed.

MR. POTTER. I wanted to point that out. I don't keep cows myself.

MR. BOWDITCH. If you did, and fed them with cottonseed meal, you wouldn't keep them a great while. I would say that in giving the Epsom salts it is a good plan to add to that a tablespoonful of ginger or cayenne pepper to avoid griping. Molasses is a very good thing.

MR. HOPKINS. How about rearing calves? is it better to leave them upon the dam or wean them?

MR. BOWDITCH. I will stumble on that directly.

MR. O. BROWN. Suppose you do not have skim milk,—suppose you were selling your milk,—couldn't you raise your calf after three months old on something else.

MR. BOWDITCH. You can help very much. It is the same principle as raising children;—if you can get milk you would rather do it—it is the best; but if the milk fails you piece out with oatmeal gruel and such things—makeshifts. Everyone has got to try it for themselves.

Mr. O. Brown. A good, hearty calf turned out to grass will usually get its living.

Mr. Bowditch. Yes—get its living, but they never get the same growth. I don't believe they ever make as valuable animals as they would if better taken care of. It is better to raise one well than two or three only half taken care of.

Mr. O. Brown. Do you feed any particular food to your bulls, or the same as the cow?

Mr. Bowditch. I feed them if anything very much less. While I work my bulls it is better for them, and it saves your building. This winter they have had nothing but corn stalks and dry fodder. They have been out only on an average a half a day. When the summer time comes I work them as you can work a team, regularly, and feed them better—give them a little corn. I put them to work when about two years old.

Mr. O. Brown. Have you any theory as regards the sex while breeding?

Mr. Bowditch. None—that is, I have a good many theories, but nothing that will work. I know a friend of mine once told me that he had. He thought he was quite sure the first year; and the second year, when he got fourteen out of sixteen, he was perfectly sure; but the third year, when on the same theory fifteen out of sixteen came males, he began to be doubtful.

Mr. W. H. Hopkins. Is there any time in the growth of a young animal fifteen or sixteen months old when you would feel perfectly safe in letting them run to pasture, or is it better to feed a moderate amount of grain from their youth up?

Mr. Bowditch. I have used different plans, and I have come to the conclusion that, with the price of grain as it has averaged for the last year or two, it is cheaper to feed a little grain and some poorer fodder than it is to depend entirely on hay; and I think your cattle will be better and mature earlier enough to pay. And

certainly all of us who raise pigs know that to get the best pig in the world you have got to keep them growing from the time they are born. The same principle is applicable to young cattle.

Mr. Hopkins. Once in a while I have a breeder come to see my cattle, and he says to me, "You feed your cattle too well—they grow too fast when young;" but I never felt I was doing myself any particular injury in the matter.

Mr. Bowditch. A great many people have told me the same thing. They very often come in and say, "That heifer is too fat, she will never make a good milker;" but I have always found a heifer may be a little heavy—look a little bit like a beef animal, and all that—but all that fat and richness, if she comes of a milking family, you are pretty sure to get it in your pail. I have tried that experiment pretty carefully with a cow I had milked several years, to test it, and have had her go dry for some length of time. In one case I brought her in weighing seventy-five pounds more in higher flesh than in another season, and the difference in the percentage of my cream, although I got the same quantity of milk, was from five to seven per cent.

Mr. Hopkins. By the way, a gentleman asked me this question. What is a fair average per cent. of cream from milk set twelve hours?

Mr. Bowditch. Well, that depends. I don't think we pay quite so much attention to the test glass as we used to—the test is in the churn. Sometimes a cow that gives a large per cent. of cream doesn't give much butter; some peculiarity in the cream will pull up more milk with it, so you really don't get as large a yield; but in butter making, why, you ought to get towards twenty per cent. of cream.

Question. What would show twenty per cent. in the test glass?

Mr. Bowditch. Yes, it varies so much that you have got to be careful in mixing your milk—take some little pains about it. It

makes a great deal of difference. I had a cow which showed sixty two per cent. of cream in the test glass, which is absurd, you know.

Mr. L. Winsor. What do you think about the condition of the cow as regards calving?

Mr. Bowditch. As I said before, a cow has a great deal more to do than in the old times. Anyone that has a cow that gives twenty or thirty quarts of milk, and makes two or three pounds of butter, wants the whole herd to do the same. A cow that gives an enormous yield and raises a calf every year has an immense strain on her. It is hard work to make a cow go dry more than a month or six weeks. They need in that time to build up their strength and be in the best possible condition to get through the calving period and begin their next term of work.

Mr. W. H. Hopkins. What is your food for your cattle during the winter—milking cows?

Mr. Bowditch. As I said a year or two ago when I was down here, for making butter I feed nothing but the best early-cut hay, corn meal—roots, if I happen to have them.

Mr. Hopkins. No corn stalks?

Mr. Bowditch. No. Occasionally if I am short I feed a few; but to make the best butter I don't think there is anything better than hay and corn meal.

Mr. Hopkins. About how much hay and about how much corn meal?

Mr. Bowditch. I give them all the hay I can make them eat; and, in fact, I think it is an excellent plan to carry out whether you feed hay or rough fodder, to begin your first feeding with your poorest fodder, then you have got to feed and feed only a little at a time, so they will eat up clean; keep adding to it. Begin with the coarse fodder, then grass, hay, clover and corn or roots last,—so you keep them eating with first-rate appetites till they are full.

Mr. Hopkins. That, you mean, is a feeding for to-day?

Mr. Bowditch. I feed twice a day only. In the morning begin with the rough fodder. I keep a man in the barn feeding all the time. He feeds a little at a time, and, as they eat it up clean, adds a little more and changes the feed. Then they are turned out to water and exercise in the yard, and come in to feed about two o'clock. He feeds at daylight, and it takes about two hours and a half in the morning and a little less in the afternoon to give them all they want.

Mr. Hopkins. Do you feed grain twice a day, dry?

Mr. Bowditch. Dry, or mixed with roots. If I am feeding roots, the quantity of grain I feed is below the average because mine is a breeding herd, and I don't think a breeding herd ought to be forced. I feed from two to four quarts of meal a day.

Mr. Hopkins. Do you object to cottonseed meal?

Mr. Bowditch. I am afraid of it.

Listener. What kind of roots do you use?

Mr. Bowditch. All roots are good for feeding, but for butter carrots are about the only thing you can feed—or a few beets, but if you feed many it is apt to give a little earthy taste to your butter; but carrots can be fed in quite large quantities, and so can pumpkins in the autumn without hurting the butter at all.

Listener. Do you feed cabbages in the season of them?

Mr. Bowditch. Not for butter.

Mr. Potter. When you feed pumpkins, do you take the seeds out?

Mr. Bowditch. Always.

Listener. You say you are afraid of cottonseed meal; do you know of any evil effects of feeding it moderately—three quarts a day?

Mr. Bowditch. I have fed less than three quarts a day and had eight pretty sick steers.

Listener. Had they been fed on it some considerable time?

Mr. Bowditch. I began by feeding a handful a day, and it took nearly a month to get up to two and a half quarts. But in feeding sheep, for instance, cottonseed meal will kill lambs ; it is too heavy —they can't digest it.

Mr. O. Brown. Won't cottonseed kill a young calf if you attempt to feed them on it ?

Mr. Bowditch. I should imagine it would ; I have never tried it.

Mr. Comstock. I have seen it tried, and I never knew a calf to live.

Mr. Bowditch. I feed a great deal of it to sheep.

Listener. Do you feed it to milch cows ?—you spoke of steers.

Mr. Bowditch. No. I happened that winter to be feeding a few steers, but I now feed cottonseed only to sheep—not to horned stock at all.

Listener. Will it do to feed linseed meal largely ?

Mr. Bowditch. Linseed oil meal is perfectly harmless. I don't believe you can hurt an animal—you can get them, perhaps, overfed, or get them scouring, but never hurt them.

Mr. Hopkins. Do you ever mix it with Indian meal ?

Mr. Bowditch. In making butter I cannot feed much oil meal, but I will say I do not like to feed shorts or bran for butter, so I am in the habit—perhaps in my herd of twenty cows there will be some reason why I want to feed a little oil meal, so I take one or two in the spring and give them a little, then change them about, —keep them in condition that way.

Mr. Winsor. You feed your corn meal clear—did you ever try oats and corn together ?

Mr. Bowditch. It is excellent, but you cannot feed a great quantity without your butter having a little bit of a bitter taste ; but it is an excellent feed.

Mr. Comstock. Doesn't the linseed meal give a bitter taste ?

Mr. Bowditch. It would, if fed in any quantity; but I tried to feed, I recollect, four or five cows out of my herd two quarts a day, and my butter people told me I had better stop it; but to one or two out of twenty you can feed a quart a day, for a few days, without any trouble.

Listener. I heard that corn meal was the best thing to rely npon if you are feeding pretty well.

Mr. Bowditch. Yes; I don't think anything makes a better quality of milk and butter than that.

Mr. Hopkins. Do you raise your corn?

Mr. Bowditch. Generally—yes.

Listener. Do you have it ground with the cob?

Mr. Bowditch. Yes; I consider northern cob meal equal to southern and western clear meal.

Mr. Winsor. Did you ever raise any calves on hay tea?

Mr. Bowditch. Yes; that is a substitute. But when you come to do it on a herd of any size, you will not be successful in raising thrifty cows such as the farmer wants to raise.

Listener. At what age will it do to feed corn to calves?

Mr. Bowditch. At ten days or a fortnight.

Mr. Chase. How long would you leave them on the cow if you raise them with the cow?

Mr. Bowditch. As long as the cow will give any milk for them—seven or eight months. I have done it with great success.

Mr. Winsor. Have you tried any of these patent feeders?

Mr. Bowditch. Yes, but the india-rubber nipples are not half secure enough, and I had a calf swallow one and it was sent into the next world. You have got to be careful about these things,—the theory is all right.

Mr. Hopkins. Those were the nipples on the bottom?

Mr. Bowditch. Yes. These india-rubber nipples are the best thing yet got up; and if you watch them carefully enough they are a very good thing indeed.

Mr. Hopkins. About twenty pounds of good hay, with corn, is fed for the ordinary-sized cow a head?

Mr. Bowditch. Yes, with three or four quarts of corn. The more grist you take to your mill the more you get out.

Listener. Farmers do not object in these days to have cows eat large quantities.

Mr. Bowditch. No. A cow is a good deal like a man;—a man that cannot eat, cannot work; neither can a cow.

Listener. What cow do you consider the best for milk and butter both?

Mr. Bowditch. You will get me to advertising my own. I would rather not do that.

Listener. Have you any special breed you prefer to another?

Mr. Bowditch. Of course we have our own individual ideas of the breed for certain purposes—the breed that will make the best quality of butter and the best color and flavor; and, after making trials, I find that I can do it with Guernseys better than any other kind I ever tried, and the greatest quantity. I do not mean to say the greatest quantity of butter produced, because it would be very easy to meet it with records published of what the Jerseys have done. There have been very few Guernsey records made. But these large records have been forced, you know.

Listener. I mean to say that you will take into consideration the quantity and the quality in your breed of cattle, and that you have one that you prefer to all others.

Mr. Bowditch. Well, I prefer the Guernseys for the reason that they are good-sized cows. They are large enough to make working cattle and their calves good-sized cows—on an average weighing 1,000 to 1,400 or 1,500 lbs.; and a breed of Guernseys ought to give from sixteen to twenty-two quarts of milk a day, and should make two pounds of butter a day.

Mr. Winsor. And the highest colored, doesn't it?

MR. BOWDITCH. Yes, they make it so high colored I had to give up feeding carrots to try and pale it a little, and haven't raised any carrots for two years on that account. They complained my butter was too high colored.

MR. J. A. BUDLONG. What price do you succeed in getting for this extra nice butter?

MR. BOWDITCH. Between 50 and 60 cents,—a little over 60 cents last year.

MR. HOPKINS. You have no silo, I believe.

MR. BOWDITCH. No.

MR. HOPKINS. What point have you observed in relation to silo in your own breed?

MR. BOWDITCH. You tried to catch me the last time I was down and spoke here, if I remember. You remember that?

MR. HOPKINS. Well, I supposed you had had some experience since then, and I wanted to know if it was more favorable.

MR. BOWDITCH. I said then I hadn't fed on ensilage, and I haven't since. I think what I said before, that ensilage butter is lower in price as a rule.

MR. HOPKINS. And it cost as much to make it by your plan?

MR. BOWDITCH. I can't say, because I don't know about the ensilage business.

MR. WINSOR. How are the Guernseys for good, ready feeders; better than the Jerseys for feeding?

MR. BOWDITCH. I never had the least trouble with the Jerseys. I am the last person to say a word against them. I went on to the Island and selected them, and bred them for fourteen or fifteen years. I held some Guernseys by accident; and deciding I would keep only one breed, I preferred the Guernseys for butter, but I never had the least trouble with Jerseys not feeding well.

LISTENER. How does the Jersey compare with the Guernsey for butter?

Mr. Bowditch. The Guernsey makes a higher colored and little higher flavored butter than the Jersey.

Listener. Not more in quantity?

Mr. Bowditch. I think not. I think it will make more on the average, but not the selected Jerseys—nothing can beat them. But take the average herd of Guernseys and they will make more than the average herd of Jerseys.

Listener. How do you account for that?

Mr. Bowditch. The same reason that you know a Jersey makes richer butter than some of the other breeds. They are a distinct breed, you know.

Listener. But the quantity you get from the Guernsey cannot be accounted for by their eating more, can it?

Mr. Bowditch. No; I have had Jersey cows that gave twenty quarts of milk and made over two pounds of butter. I don't want to say a word against the Jerseys; they have many characteristics that the Guernseys have not. They are much better looking to tie out on the lawn; but for the purpose that the average farmer wants a cow, I think the Guernsey is fully as profitable as the Jersey.

Mr. Hopkins. The average herd of Guernseys would be larger?

Mr. Bowditch. Very much larger. I have had a bull that weighed within two pounds of a ton, and one of my friends here has seen some pretty large Guernseys in my barn. I have one to-day that weighs 1,500 or 1,600 pounds.

Listener. A Guernsey is better for meat than the Jersey. It grows larger and produces a better animal for the butcher?

Mr. Bowditch. Yes. The Jersey beef is very good as far as it goes, but the Guernsey cow will weigh 1,400 pounds alive and a little Jersey perhaps 750.

Listener. The question is whether it would be as good?

Mr. Bowditch. Yes, as good; it is very excellent.

Mr. Budlong. Whether the Jersey would not cost as little for the pound?

Mr. Bowditch. I do not think so; I think the Jerseys are large feeders for their size.

Listener. Do you pasture your cows through the summer?

Mr. Bowditch. Pasture some, and feed generally night and morning through the dryest part of the season. The pastures at this end of the world are not as good as in the middle states. I only have pastures enough to carry me till July, and then for two or three months I feed grain stuffs: peas, oats—whatever I can get. Corn fodder is the main reliance of us all.

Mr. Hopkins. Is rye good?

Mr. Bowditch. Yes.

Listener. Do you have any trouble from the oats in your butter?

Mr. Bowditch. Never.

Listener. How large do you allow it to get before you stop feeding?

Mr. Bowditch. The cow can tell you when to stop; they don't like it after it gets large.

Mr. Peckham. What age do you consider the best bull for breeding?

Mr. Bowditch. When he is thoroughly matured.

Mr. Peckham. Three years old?

Mr. Bowditch. I have had them four, five, six and seven. If they are kept in the natural condition I think they always improve as they grow older. It is the same with males of any breed. I think I get my best lambs from my four or five year old ram as a rule.

Listener. How far would you extend that?

Mr. Bowditch. As far as practicable. A friend of mine in Pennsylvania bred his bull till he was twelve or thirteen years old, but it is not practicable in a small herd. I find I can work it practically till about five or six years old. You would have to keep too many.

Mr. Hopkins. Do you ever work your bulls singly in carts?

Mr. Bowditch. I have; but it is a very good plan to have them yoked together, because, if they are going to do anything wrong, they don't both take exactly the same idea at the same moment.

Mr. Hopkins. I have got one that I want to work alone, and I have got a pair I want to break.

Mr. Bowditch. There is no trouble,—I have worked them, and they work admirably in a tip-cart. You don't have to go to any expense; just take a horse-collar and put it on upside down, and it comes just about right.

Mr. Hopkins. That is quite an idea. I thought you had to go to work and get a yoke.

Mr. Bowditch. You wouldn't find anything to work better than a large horse-collar; buckle it with the small point down and then put your shafts in the rings with the hames reversed. There is one thing,—you want your hames strong and your rings strong, because you want to put the weight on the neck rather than on the back. Don't try to load heavily on the back—they can't stand much weight there; they get very easily slay-back.

Mr. O. Brown. Do you have any trouble with their fighting each other when you work them together?

Mr. Bowditch. No, only when you break them in. They are pretty lively when you first yoke them up—they generally take possession of the yard for about twenty-four hours.

Mr. Hopkins. I leave mine right out together. They won't injure each other when they are brought up together.

Mr. Bowditch. No, they work very well, but when you have to yoke up a pair I would suggest that you take two yokes. You will find it safer if you have two yokes, if they are strong. It is not a dangerous thing to do. They cannot hurt each other; they cannot get away; they never get the same idea in their heads at the same time—so you can get out of the way. With one bull broken in,

you can break in your second one very easily. I have had one ploughing in four hours from the time I yoked him up; the furrow wasn't very straight, but still he ploughed.

MR. HOPKINS. Have you ever tried them for horse power?

MR. BOWDITCH. No, I have not; we would require to have them shod. I don't think it is well for them to run the risk of their slipping and straining themselves. They are rather unwieldy, too.

MR. O. BROWN. What is your experience in breeding lambs for the market? When is the proper time to have your sheep come in?

MR. BOWDITCH. The earlier the better. I don't know how you are in Rhode Island, but I know in Massachusetts we have got hundreds of acres that are producing nothing under God's heaven now that might be made productive; and I don't believe there is any worn-out farm in New England that any enterprising fellow cannot take hold of and make a living out of with pigs and sheep. If I should tell you the net per cent. I made on sheep one year you would not believe one word I have told you this afternoon.

LISTENER. I guess you had better tell us.

MR. BOWDITCH. I made over 90 per cent. net.

LISTENER. What was the amount that you received?

MR. BOWDITCH. I bought my sheep on the first day of July and closed the account on the first day of May, and in ten months I had made over 90 per cent. net.

LISTENER. You sold your stock?

MR. BOWDITCH. What I kept I charged at the same price.

MR. POTTER. Do your neighbors keep dogs?

MR. BOWDITCH. Yes, and I have got fifteen. That is very easily got rid of; haven't you got any dog laws?

MR. POTTER. Yes, but we haven't got any sheep.

MR. BOWDITCH. You can't blame a dog for killing sheep. If you raise a pup he is very apt to chase the hens and pull the clothes

off the line; still you don't give up keeping hens or washing your clothes. You teach the dog to behave himself. You have got to do the same about sheep,—it is a question of education.

Mr. Potter. Yes, but lots of dogs from the city will tramp out in the country, and we can't train those.

Mr. Bowditch. Yes, you can—with a shotgun—first-rate.

Mr. Potter. Yes, but they generally come around when you are not prepared for them.

Mr. Bowditch. You can't get anything in this world without a little fight for it, and it pays to fight for sheep.

Mr. Potter. That's hard on us Quakers. (Laughter.)

Mr. Bowditch. You've got me now. Of course I don't know what the dog laws are in Rhode Island. I have been very much interested in the laws of my own State; and while I thought when I first began that our laws needed a good deal of amendment, I have ceased to ask for anything except that the farmer should get the damage paid to him at once.

Mr. Potter. We get it here, but a man has got to apply immediately to get damages.

Mr. Budlong. If the damage is too great we get a pro-rata—not the entire damage.

Mr. Hopkins. I have had sheep killed by dogs in Massachusetts, but I never got anything for them—there was too much red tape. It was always a little too late to make application.

Mr. Bowditch. The law in Massachusetts is, when your sheep is killed, you have got to give notice at once before the sheep is touched. He comes and sees exactly how the sheep is lying, and he decides whether it is best to have an expert. If the damage is over $25 he has to employ an expert.

Mr. Hopkins. This sheep of mine ran into an old ledge, and I found it after it had been there a day or two.

Mr. Bowditch. That wouldn't have made any difference.

Mr. Hopkins. They said it was too late.

Mr. Bowditch. The great trouble is with dogs and with our law. A dog that is seen troubling sheep in any way you are allowed to kill; and I always stretch a point if I see a dog looking through the fence at my sheep, that he is worrying them by looking through.

Listener. I was annoyed very much while I kept sheep by dogs driving them home—jumping over into the yard and running after them, etc.

Mr. Bowditch. My sheep haven't the least fear of a dog. I wicket them with a collie dog every night. I keep a good many dogs. They are perfectly used to my mastiffs.

Mr. Potter. It is not our own dogs that kill sheep—a dog never kills sheep at home, and they don't generally kill them in the day-time. Over here in Seekonk Plain there used to be thousands of sheep kept; now there are none—for two reasons: the railroad was one; but the principal reason was the dogs from the city came out and killed them.

Mr. Bowditch. Well, mine pay me so well that I feel I can afford to look after my sheep carefully. I have put a bell on every sheep I own; and, as I run two hundred or more, if anything does startle them, somebody hears it. Then I hurdle them at night in a picket fence hurdle. You accomplish two results in that way,—it is safer on account of the dogs, and then I feed a cent's worth of cottonseed meal a day and makes a top dressing for the land. There is no way you can get a top dressing as cheaply as that, and the land will remember it a long time.

Listener. How old do you market your lambs?

Mr. Bowditch. It isn't a question of age, but of weight. If they are fat—from twenty-one pounds upwards at this time of year.

Listener. Do you raise sheep with a view of selling the wool, or for the market?

Mr. Bowditch. I raise lambs for market, but wool helps very much.

Listener. What breed do you use?

Mr. Bowditch. I breed a Hampshire ram on a South Down ewe.

Mr. Brown. What was your treatment of the sheep that you made 90 per cent. on?

Mr. Bowditch. Very much the same as now, only it happened to be a very lucky year for lambs. I averaged $8.40 on all the lambs I sold, and I sold one hundred and thirteen.

Mr. Greene. What was the price of the meat per pound?

Mr. Bowditch. I sold them by the carcass wholly, without any pound about it at all. In the early spring lambs are sold by the quarter, not by the pound; they rarely sell by the pound till late in June or July.

Listener. Do you sell them on their feet or dress them?

Mr. Bowditch. Dress them. You can figure the profit for yourself very easily. It costs between four and five dollars to take care of a ewe for twelve months—feeding her a little grain—and the manure you get is valuable: it balances the labor; and one man can easily take care of three or four hundred. It doesn't make much more work.

Mr. Hopkins. Is it a fact that when sheep are used to dogs brought up with them, they won't be afraid of dogs and dogs won't touch them?

Mr. Bowditch. My farm is pretty large and I am on horse-back a good deal of the time, and I always have a mastiff or two following me. Late in the fall when I let my sheep roam, if I try to drive a sheep back from a lot on horse-back with the mastiffs behind me, I cannot do it; but when I call the dog they know the difference, and they go very quickly. They are very intelligent. The sheep isn't half as stupid an animal as they are thought to be.

Mr. Winsor. How much land does it take to run your two hundred sheep?

Mr. Bowditch. That depends entirely upon what condition your land is in, and how much corn you feed. I run forty acres and feed a cent's worth of cottonseed a day.

Mr. Hopkins. Farmers used to say that ten sheep was equal to one cow.

Mr. Bowditch. I was going to say about the profit on sheep. It costs us $5 a year, and that is very liberal. It takes as good care as any sheep ought to have. You get on an average $1.50 or $1.75 for the wool, and it would be a very poor season that you didn't average $3 or $4 for your lambs. I never have averaged less than $6; but even at $3—I don't believe we shall ever have to go below that; and you can see for yourself that is very good interest on your money. I am putting things at a minimum figure. I will give you my figures of last year: It cost me $4.42 to keep each sheep; I sold about $1.80 worth of wool from each sheep, besides $6.41 for a lamb—a little more than that. You get an average of a lamb and a quarter.

Mr. Greene. Won't one lamb as an average bring more than two?

Mr. Bowditch. Well, you don't get your twin lambs in as early. For instance, now, I have got some twins that are not old enough to go, but I have sold the single lambs of the same age for fourteen or fifteen dollars; but these other lambs will come on some days later, and I will get about ten or eleven dollars apiece for them.

Listener. How long before you take them before they are ready for market?

Mr. Bowditch. When they will weigh enough. It is according to how good your ewes are and the breed is. A lamb thirty days old will eat nearly a quart of meal—and eat more than you would dare to feed it. I have dressed a lamb twenty-nine days old that weighed twenty-three pounds dressed.

MR. GREENE. If you should keep those lambs till they were one hundred days old, what would they probably weigh then ?

MR. BOWDITCH. They would probably weigh, dressed, sixty pounds.

LISTENER. Would they be worth as much in proportion ?

MR. BOWDITCH. About twelve or fourteen cents per pound. You will run the risk of their dying, having to feed them longer, and they bring less money,—not mutton prices—between mutton and lamb.

LISTENER. Would you get more for lamb forty days old than ninety days, per pound ?

MR. BOWDITCH. It depends on the weight—the earlier you get them into the market. For instance, lambs are very scarce. Now at this time you can get any price you like for them, practically. In another month other people will have lambs in the market, and by the 10th or 15th of May lambs will come on from Kentucky and Tennessee, and lamb goes down.

MR. BUDLONG. Money is made by knowing how.

MR. BOWDITCH. There is a great deal in that.

LISTENER. How much will your full-grown sheep weigh ?

MR. BOWDITCH. The best sheep I had weighed about 290 lbs. alive,—that was a ram; but they would usually weigh from 150 to 190 lbs.

MR. BUDLONG. You require to have some nice arrangement to protect these animals from the cold in winter ?

MR. BOWDITCH. For twenty-four hours after the lamb is born; then their lamb's wool jacket is enough to stand anything but these confounded winds we have had. They don't mind the still zero weather at all. It is a great mistake to think in keeping sheep you must keep them warm; you can kill them easier by keeping them warm than by freezing. Keep them in good weight and they will stand any amount of cold. You have a comfortable shed well

littered with straw, and a decent yard not exposed to the air, and with the thermometer at twenty degrees below zero, you will find more than seventy-five per cent. lying out in the snow.

MR. GREENE. Do you allow your lambs to run with the sheep in the autumn ?

MR. BOWDITCH. Yes, till winter comes.

MR. GREENE. I mean those lambs you are fitting for market.

MR. BOWDITCH. Yes, I feed all my lambs till they are sixty days old more or less with the sheep. I have, in the corner of the yard where the ewes and lambs are, a separate rack of grain and rowan, where the lambs can get in and the ewes cannot. Lambs are a pretty good deal like a growing boy—they will eat all day.

LISTENER. How would your sheep pasture compare with where you pasture other stock ?

MR. BOWDITCH. It is equal—if you feed a little grain, it is equal to a liberal top-dressing. It improves a pasture wonderfully. The pasture that I run one hundred and ninety sheep on, kept in a half-starved condition the year previous.

LISTENER. Suppose you didn't feed the sheep any ?

MR. BOWDITCH. It improves, but not as fast. They feed a good deal on twigs and they kill out a good many bushes, and in that way give it a certain amount of top-dressing—not so much, though, as if you fed grain.

LISTENER. It would rather deteriorate if you pastured stock there some length of time ?

MR. BOWDITCH. It would not improve.

LISTENER. It has been my experience that when sheep run several years it would improve considerably ; but when you turn cattle out there it would want taking up.

MR. BOWDITCH. The sheep top-dress more evenly. Other cattle do not have as much effect—it isn't spread.

LISTENER. I should like to ask what time you prefer the lambs to come in ?

Mr. Bowditch. I should like them all before Christmas if I could. I had one this year on Christmas day.

Secretary Smith. Mr. Bowditch comes to us a practical farmer, although, as we sometimes say, born with a silver spoon in his mouth. He left his residence in the city of Boston, and took off his coat and went to work on a farm as other farmer boys have done, and followed up the business quite successfully. I move, in view of the interesting address we have had, that a vote of thanks be extended to Mr. Bowditch.

The vote was unanimously adopted, and the meeting adjourned.

NINTH LECTURE.

The ninth meeting of the series was held on March 18th, at 2 o'clock, P. M.

Secretary Smith announced that at the next meeting an address would be delivered by Edward Burnett, Esq., of Southboro, Mass., on "The Channel Islands, the Cattle and the Farmer." Mr. W. H. Hopkins was chosen chairman of the meeting and introduced the first speaker, Mr. Philander Williams.

MR. WILLIAMS' ADDRESS.

Mr. President and Gentlemen:—Ten years ago, had it been announced that someone was to speak to you upon the subject of poultry-raising, you would have said the person was a crank or a fit subject for an insane asylum. But, for the past few years, people have begun to take an interest in the raising and management of poultry, which is one of the largest and most important industries of the country.

That there is plenty of room for improvement in this branch of commercial industry, we realize more and more every day, and those that have been satisfied to keep a dozen hens, and really did not know where the poultry-house was located upon the place, or who fed them, or what they had to eat, begin now to take in the situation and show a desire to learn and develop this important part of the farm stock.

This is an age of improvement—an age of invention—and why should not men of intelligence, culture and ability turn their attention to a calling which, if properly managed, will insure them a handsome profit?

The poultry-raisers of the country may be divided into two classes—those who keep poultry for eggs and market and those that raise poultry for a hobby or pleasure; and, first we will speak of the class that raise poultry for eggs and market, because it seems to me this portion of our people are, or should be, the most interested to make it profitable, and we will not suppose they wish to do it for any other reason; while the raisers are looking after their own interests, they cannot but benefit the people of the whole land, as *they* are the consumers. But I hear some one say: It will be like all other business—so many will engage in it, that the price of chickens and eggs in the market will become so low that it will not pay to raise them. Now, you will readily admit that the quantity of eggs has increased the past few years, but they still sell at a good round price, and we import eggs every year, and the same can be said of dressed poultry. It may be that prices for these products will be a little lower; but, by paying proper attention and adopting the improvements at hand, I venture to say poultry and eggs will always sell at a profit to the raiser. But this is not what you wish to know. You wish to know how these improvements can be made; or, in other words, how can we raise large quantities of poultry and eggs and make it pay?—how can one keep a thousand hens, and keep them healthy, and make them profitable? If my experience of thirty years is worth anything to you, I am only too glad to give you my ideas whether they are worth anything or not; and, first—

POULTRY HOUSES.

This is one of the most important parts of the business. Some will tell you to build houses one hundred feet long and fifteen feet wide, and keep all your stock under one roof, because it takes less time and hence less expense, to care for them. But my experience tells me this is not the best way, because your yards would have to be too small; and should some contagious disease visit your flock, you would lose a greater number of fowls than you would if they were in smaller houses. I should select a southern slope if possible, and build houses that would hold fifty hens comfortably.

Have it front the south and about twenty-five by fifteen feet. I have it fifteen feet wide to give them ground room when confined in winter. For windows, I would have common window frames with two sashes, that they may be raised and lowered, as need be, in warm weather. In a house twenty-five feet long I would have five windows on the south side, and one or two in the east end. Ventilation is one of the most important things, and I would have one ventilator through the roof—good size—and ventilate from the top or bottom as you believe to be the best way. I have not studied ventilation sufficiently to say which way is the best. I have both. I would have a platform to run the whole length of the house on the north side, two feet or two and a half from the bottom of the house or floor; and have one or two roosts, according to the size of your hens, run the whole length of the platform, and have them rest on standards, and not touch the house or be fastened to the standards. I recommend this platform, as you will be more apt to keep the house clean than you would if the droppings went on the floor.

I do not fasten the roosts for two reasons. First—you can remove them when you clean off the platform; and I am often asked what I shall do to kill the vermin in my poultry-house. If you will look under the roosts where they have a bearing, when warm weather comes on you will probably find a few red mites or lice. Apply kerosene oil or carbolic acid and it will kill them, and then through warm weather turn them over occasionally and use the oil or acid, and you will not be troubled with lice; neglect it, and you will have lice.

Now we have the house done—the next thing is how to keep the occupants; and one of the most essential things is

YARDS OR RUNS.

No hens will lay as well yarded as they will if they have a natural run to go as they please, and no eggs will hatch as well when hens are yarded as they will if they run natural; and, if you have the room, be sure and not confine them. But if you do not have the room, have your yards seeded down to grass, and have them large enough so the birds

will not kill the grass, as it is absolutely necessary they should have grass to eat. Many sow down their yards with oats or rye, and this is a grand thing, and will also pay in eggs. Next—

HOW TO FEED.

We all differ in our mode of feeding, and different breeds require different feed. If you keep Leghorns you cannot feed too much, as they never get fat. If you keep common barn-yard fowls, and they are not old hens, they, too, will bear high feeding. If you keep Brahmas or Plymouth Rocks, pullets will bear high feed. But in the second year you should feed oats and wheat—no corn, or very little, or they will keep too fat to lay. There are many prepared compounds in the market that are said to increase the production of eggs. I have no doubt they will, and a proper use of them may be beneficial. Hens when confined need much more care in feeding than if they run at will. A laying hen is a very active animal, and will often get into mischief, such as eating, plucking feathers; and to prevent this, study their wants, feed mangel-wurzels, raw potatoes, cabbage, and, once a week, raw onions. You will find them greedy for all these extra things, and they will pay you in eggs for all the extra feed and care. The best way is to kill off all hens about the first of June, and the reasons for this are obvious. If allowed to moult they will lose two months, as a rule, of laying time, and then when they get on their new feathers they will be more apt to take on flesh, and so not lay until spring.

WHAT KIND OF FOWLS TO KEEP

is a question often asked, and we may not all agree. If I were to start anew and had no stock or experience, and I did not have an eye for the beautiful, or, in other words, my object was solely poultry and eggs, I think I should collect good-sized mongrel pullets in August or September—not later than September—as you want to get them accustomed to their new quarters before cold weather sets in, to guard against colds, etc. These pullets should not be hatched later than April to insure them to commence laying before Thanksgiving, when

eggs command a good price. With these common or dunghill pullets I would put a pure-bred male, either a small-sized Light Brahma or Plymouth Rock. I do this to increase the size of the chickens, so when you kill them for market you will have a good-sized bird, and a dozen cockerels will amount to something. Now we have the pullets laying in November, and I pretend to say it lays all with you whether you keep them laying through the winter or not. Some families have plenty of eggs in the winter, while their nearest neighbor with the same stock has none. I have had people tell me they gave their hens the best of care, and they did not lay at all. When in New York many years ago, in the fall, a man from New Jersey told me in the presence of others that he had a Light Brahma cockerel hatched in May that weighed ten pounds. As I could not credit it, I asked him if he was sure about it, and he said "Yes." I asked the second time, and the answer was the same. A friend of mine who stood by me said, "Williams, you must see that bird," and we went home with the gentleman and passed the night with him. We were splendidly entertained, and after a nice breakfast went out and caught the bird and weighed him—just eight pounds. He pretended his scales were not right, but it was of no use, the bird weighed two pounds less than he declared he did, and we had our trip for nothing. But we did get our supper, lodging and breakfast, and when a person tells me they take the best of care of their hens in the winter and get no eggs, I always think of that man.

Do you ask,—How many hens to one male to ensure fertile eggs? There is no rule that will apply in all cases, but I venture to say if a flock of fowls run at large one male will take care of twice as many females as he would if they were confined. I have known a cockerel to run with twenty Light Brahma hens and almost every egg hatch.

Now, all these things look easy enough, and many will say "I will start in the poultry business and my success is sure." But there are many things to learn, and you had better begin small and learn as you progress. Would you expect your son to enter upon a mercantile business without first serving an apprenticeship? Would you expect him to practice a profession without first studying for it? and so you will find it

in the poultry business. You may read all you will. You may have thousands of dollars at your command, and yet you can make a failure of raising poultry for eggs and market. So begin with fifty hens, take good care of them, learn their habits and wants, and if you make fifty pay, then try more, and add to the number as you learn, and you will find poultry-raising will pay you more profit for the amount of capital invested than any business you may choose.

There are, as I have said, improvements in this business in these days that it would be well for us to consider. I refer to incubation and brooders. I have often said, and I repeat it, that I fully believe the time will come when every well conducted farm will have its incubator as well as the mowing machine and reaper or sulky plow. Who ever thought a shoe would be made by machinery? I well remember of saying: "They might get all the machines they pleased, but they never could peg a shoe by a machine"; but five years after I said that "No one pegged a shoe by hand!" At the present time very few succeed well with incubators, but this is not the fault of the machine. Mr. Rankin will hatch more fertile eggs with his Monarch Incubator than I can possibly with hens—while I, perhaps, can't run his machine and make it a success. There are a host of incubators in the market, and I believe nearly all will do the desired work after we learn how to run them. I believe one must have some mechanical skill and ingenuity to run an incubator. I know of several that will have splendid success with the same machine that others make a complete failure of; and we can only wait and practise and calculate that our chances of success and failure are about equal. I would not be without an incubator if I cannot run it and make every egg hatch that is fertile. I find it very handy when hens are hatching to take out the eggs after they are picked and put them into the machine and let them hatch out, and thus save many chickens that would be killed by the hens.

There is much more that could be said upon raising fowls for market and eggs, but I will pass on and say a few words about the class that raise poultry for a hobby or pleasure and sell their surplus stock, and it is with this class that the speaker belongs.

I did not have to cultivate a fondness for animals, and from early boyhood until now the horses, cattle, poultry, dog and cat have always had a true friend in me. Having chosen a mercantile business, it has not been convenient for me to raise horses or cattle; but I have always found a place to raise poultry, no matter how many obstacles were placed in my way. At first I was very private about it, and was really ashamed to have my associates know I had a fondness for chickens; but as time went on, and I became acquainted with others that, like myself, were interested in raising pure-bred poultry, this feeling gradually has worn away, until to-day I am proud to be classed with the raisers of pure-bred poultry of the country.

Do you wonder what there is so fascinating about this business? I can only say it is a desire to improve his stock, and in order to do this, he must learn how to mate up his breeders and watch the result; and I have studied, watched and waited years before I could, by selecting my breeding stock, produce my ideal bird, and never has it been my good fortune to be able to raise a specimen that fully filled the requirements. I once heard a minister say, "A man will take a rocky, stubborn piece of land and dig out the rocks and roots, and after a while he gets it subdued, and laid down neatly to grass; and then the interest he took in making the improvement and the fascination it had for him all leaves him, and he wants to sell that piece of land and buy another." And I suppose when I can raise a chicken that fully fills the requirements of my "ideal" bird,—then, and not until then, will my interest in raising poultry flag. I once said that it required more skill and brains to raise a first-class Light Brahma, and do it year after year, than it did to raise cattle.

But perhaps this does not interest you, and you ask what practical value is there in pure-bred fowls? I will tell you. We have improved the size of the eggs of the country. We have improved the size of the dressed chickens. We have made breeds that have taken the front rank among the poultry of the country as egg producers; and still there are those whose study and aim is to produce a fowl that will possess the egg producing qualities and also be a good fowl for the market;

and the Plymouth Rock fills the bill quite well, and I doubt if a more practical bird can be found than the Plymouth Rock. The Light Brahmas also have a practical value, as they lay more eggs in the fall and winter months than a bird that carries less flesh, and pure breeds have a practical value also to use as crosses.

One of the best fowls in the world for eggs and market is a Brown Leghorn upon Partridge Cochin China, or a White Leghorn upon Light Brahma females. I recommend these crosses as they produce a uniform size and color, and to me a flock of hens that look so near alike you cannot tell one from another, is a beautiful sight.

Years ago, if we needed new stock, we were obliged to send to England for it; but to-day I think we can equal, if not excel, our English cousins in raising pure-bred poultry, and we have a good demand from across the water for our Plymouth Rocks and Wyandottes.

Those that are not particularly interested probably will be surprised when I tell them I know of one man, who keeps two varieties only, whose sales last year amounted to $1,100; and there are plenty of others that make a profit of one thousand dollars a year besides attending to their regular business.

I once had a letter from a perfect stranger, who said: "Williams, you are a public benefactor." I will confess I had not thought of it in that light; but he, being a person outside, and taking a broad, unselfish view, could see what I did not see.

It seems strange to me that farmers, as a rule, are not willing to make improvements in their stock. It costs no more to keep good stock than poor. If I was a farmer I should try and have my stock adapted to the location of my farm. If near a village or city, I should probably sell my milk, and I would have Dutch or Ayrshire cattle, as they are the largest milk producers, and I would have them registered and good of their kind.

If my farm was so remote that I must make butter, then I would have Jerseys; and in all my live-stock I would have only pure breeds, and they such as would give the best returns. In poultry I would take one pure breed. Such animals, if well bred, would certainly sell for

more money, and it would cost me no more to keep them than scrub stock. It might cost more to start, but I would begin small and work up, if I did not have the money to purchase all my stock. I really believe there are breeds of swine that can produce a pound of pork at one half the cost of other breeds. But I have wandered from the subject of to-day, which is poultry. If there are fathers here to-day that have boys at home and they have a fondness for pets or like poultry, I would advise you to get some for them and assist and encourage them all you can. Have them keep a strict account with their fowls. It will teach them business, and keep them many times from mischief. Show me a boy that is fond of pets, and he will be a good boy, with a kind, warm, generous heart.

One word about the purchase of pure-bred stock. To insure success in producing fine specimens, it is necessary to have the birds you buy well bred. To illustrate: The pencilling of a Partridge Cochin hen or pullet is very essential and adds much to its value, and in order to produce well-pencilled females of this breed, you should breed a male from well-pencilled females, and too much care cannot be taken in purchasing your stock.

I once knew a man to buy in war time a setting of Dark Brahma eggs from a breeder in Canada. I think the party in Canada asked him $10 in gold, and gold was worth such a premium that his eggs—thirteen in number—cost him $33. The eggs hatched well, and he called the chickens his "Thirty-threes," and he has often told me that was the best purchase he ever made in the poultry line.

I would thank you for the attention you have given me, and if I have said a word or dropped a hint that will prove of service to you, I shall not only be glad, but feel that I am well paid for the effort I have made.

The following paper was then read by Mr. H. A. Mansfield, of Waltham:—

MR. MANSFIELD'S ADDRESS.

Mr. President and Gentlemen:—I have been asked to say something to-day on the subject of Poultry, but I fear after listening to such orators and experts as Mr. Felch, two weeks ago, and Mr. Williams, to-day, nothing from me will be particularly new to you. I am encouraged however, by the thought that a truth cannot be too often told, and loses none of its value by being repeated. When we realize that some of the best things ever said for the good of man were said nearly two thousand years ago, and sermons have been preached every Sunday since from the same texts, I think we may be excused if we reiterate some things that we or others may have said before on a subject only about forty years old.

The title of this society signifies its object, and I consider the cultivation of Domestic Poultry a legitimate Domestic Industry, and one of the most pleasant and profitable occupations that can be followed by those who have a taste for it and the necessary facilities for conducting it successfully. There are many of us who devote much time and study to certain varieties, looking only to the satisfaction and gratification we have in improving them.

The fascination and delight one feels when he has been successful in his *matings* for a particular object cannot be described. When you tell a man he shall not or cannot do a thing, if he is made of the right kind of material he is quite liable to try at least, and the chances are two to one, if the thing is among the possibilities, he will succeed. At the same time the man who raises the so-called fancy poultry, after his own enjoyment dares not despise the prices that a brother fancier is always willing to pay for specimens that *he* wants or thinks he needs to improve his own flock.

There are two classes interested in the cultivation of poultry. The class of breeders who keep only thoroughbred fowls in their purity and those who raise them only for meat and eggs, both very large classes, each valuable to the whole community.

The breeder of standard specimens of different varieties often spends what to the novice seems fabulous prices to import the best specimens

of his specialty that can be obtained, sometimes, too, he cannot see his money's worth in what he gets; again he will receive specimens so elegant that he forgets those that did not suit him and feels well repaid for the outlay, especially if his new fowls breed well. I have made many importations; some did not entirely please me, others were all I could expect, and as a whole the experiment has been satisfactory.

Many years ago the man who kept the most kinds, was considered the best party from whom to purchase, but those were the days when the country store keeper kept a poor assortment of everything; he was also postmaster, dentist, doctor, justice of the peace, and occasionally preacher.

Now the successful men are men with specialties,—with hobbies, if you please.

Who could tell Edison anything about electricity, Vanderbilt about managing railroads, or the American people, generally, about enterprise, success and general prosperity? In poultry breeding, to-day, the man who makes a specialty of only one kind that he loves and cares for with his own hands, is the man most likely to succeed with that variety. It is true that a large majority of the winning specimens all over the country are the result of the care, study and experience of a few men belonging to the class I alluded to a little while ago, who are content to raise and sell what they can spare, let the purchasers enjoy what they can out of exhibiting them.

We see many advertising "the best," "only reliable," "clean sweeps," &c., but often when these breeders (?) *do* win a premium it is done with a specimen purchased at a round price, perhaps from some modest party who is unknown to the fraternity, he having never exhibited or advertised. I knew a case the past season where a successful breeder left a few chicks (that he did not care to send away or breed himself,) on the farm where he had them raised, instructing his man to kill them for market. Three other breeders of the same variety heard of them and eagerly bought them, knowing their pedigree. Each one had openly advertised to have the best of that kind in America. I expect soon to see them advertise imported stock direct from the yards of Mr. So and So.

The second class, and the larger one of the two, are those who raise poultry and eggs for market. I am satisfied there is no more pleasant or profitable occupation in connection with general farming, or for the villager who has even a small lot in town, than the care of poultry. A gentleman in Michigan had a large farm and a large flock of fowls, no two alike (except that all were worthless,) all wild as hawks, roosting in trees, on harness pegs and on everything but in the right place. In the summer they laid in the fence corners and under hedges; in the winter nowhere. I induced this gentleman to shoot his entire flock, and gave him a trio of Dark Brahmas. The first season he raised about fifty chicks, killing all but eight pullets and one good cockerel. Next year he raised about one hundred. In the fall he culled these down to forty-two hens and pullets and three or four cockerels. They were hatched in March and April and commenced to lay in October. By the first of April he had sold eggs for table use amounting to $60,—nearly $1.50 for each hen during the winter, and had all they needed to use in a large farm family besides. This result can be attained by any farmer. I was there in the fall and saw him sell twelve cockerels that weighed one hundred and twenty pounds. I kept a strict account one year of the eggs laid by eight hens, crediting them with what I could have sold them for for table use. The eggs they laid averaged $4.50 each hen during twelve months, mostly in winter when the price was highest. I do not mention Dark Brahmas as being any better than many other varieties. They have been my favorites, and you will pardon me for alluding to them, as my experience for the past four years has been entirely with them. The best kind for any man to keep I have often said is the kind he likes best. I have often been asked what kind I would advise a man to keep. I try to find out what kind he likes best, then I tell him that kind. Josh Billings once said, "When a young man comes to you for advice, first find out what sort of advice he wants, then give it to him, he will then call you a philosopher and follow your advice." A man was once asked what he considered the best breed of pigs; he replied that he thought it was about one-third in the breed and two-thirds in the feed. The same rule applies to some ex-

tent with poultry. I am free to say I think one reason why people succeed better with improved poultry, is the fact, in the first place, they cost them more, consequently they give them better houses and better care. For general use the year round for meat and eggs, I would use Brahmas or Plymouth Rocks. They are hardy, prolific layers in winter, when eggs bring the best prices, make desirable poultry when dressed for market, do well when it is desirable to confine them in limited quarters and have as few faults, I think, as any.

I think what the man said of strawberries might apply to the fowls I have named. He said, "Perhaps the Almighty could make a better fruit than the strawberry, *but he never had.*"

As I said in Boston a week ago, the American fancy for the yellow skin and yellow shanks, is without any good reason. The Dorking, Houdan and Game are submitted the world over to be the very best of table fowls, yet neither has yellow skin or yellow shanks. The partridge, quail, woodcock and snipe, are considered equal to any yellow legged chicken I ever saw. Yet for this or any other market it pays best to raise what there is a demand for. Life is too short to spend it in trying to introduce new varieties, or spending one's time over a new style of comb or a new color for an old variety. Any man can find enough to do to start with the best he can get of any of our old and known-to-be-good varieties, and try to improve them without ignoring the labor of the best breeders all over the world for the past forty or fifty years, expecting to produce something better. His chances of success are not one in a million.

Houses should be so constructed that they are perfectly dry at all times, properly ventilated and kept clean. Those three conditions will do away with the necessity for tonics, roup pills, insect powder and special egg foods.

Keep them not too warm, but as even in temperature day and night as convenient.

I have two houses the same size, one gets quite warm during the day when the sun shines; the other less exposed to the sun is much colder. Both are cold at night. I have the same number of the same kind of

fowls, the same age in each, all have the same care otherwise, but those in the coldest house have laid much the best during the past winter, a more even temperature being the only cause I can give. Feed should always be of the best quality and dealt out *sparingly*. I am sure many more failures follow the too liberal feeding than not feeding enough.

I aim to keep my fowls always with a sharp appetite, they are more active, lay more and larger eggs, the eggs hatch better and hatch stronger chicks. The same is true of all breeding stock, I think. Last year I visited Mr. Wolcott's place at Milton, where he raises Yorkshire pigs. His breeding sows showed their ribs like hounds. I expressed surprise. He smiled, and asked me how I liked the little pigs. They were fat and sleek as moles.

For laying hens I consider corn the most undesirable of any grain—it tends too much to fatten.

Wheat bran with a small portion of corn meal and ground oats mixed only moist with boiling water slightly salted is my morning feed, at least seven-eighths in bulk bran. I feed liberally of this in the morning. Afternoons I feed oats or wheat, not now more than half what they would eat if they had it; occasionally a little corn. Young chicks cannot be over fed, so they eat up clean all that is given them.

Eggs are particularly sensitive to the influence of food. Onions fed to hens flavor their eggs, beyond a question, and anything that would be objectionable in the flavor of an egg should be avoided if the eggs are to be eaten. The same is true of filthy water for fowls to drink. Invalids appreciate this fact most keenly. No one would care to offer a friend who was hanging between life and death an egg that would disgust them on account of the filthy manner in which the hen had been fed.

The cost of keeping fowls will not exceed about $1.25 a year, where everything is purchased of the best quality for fowls confined in limited space. On a farm where they have full range the cost will be much less. This has been my experience, and any of the varieties I have recommended will lay eleven or twelve dozen eggs in a year at a low estimate. It is an error to suppose poultry will succeed on land so

poor that it is worthless for other uses. Where you can raise the best corn and potatoes, it is there you can raise the best chickens. One year I farmed three lots on different kinds of land to test this question. On one place the land was dry, sandy soil, they had plenty of good grain, clean water and good houses, but no tender grass and insects. They never amounted to anything, were faded in color, pinched in plumage, and body small and general want of thrift pervaded the flock. Another place the land was ordinarily fair, they had good shelter, good grain and water, were better than the first, but not satisfactory. In the last place they had land fit for a garden, plenty of tender vegetable growth, worms in abundance, and a running spring brook to drink from at will, no more or better grain than the others, but they were large in size, with plumage of elegant color and quality, nearly all fit for exhibition. They were all from eggs laid by the same hens, hatched about the same time, and the only difference in treatment was the land on which they grew. Yet no one would believe that they came from the same stock to see them. I think this is often why those to whom we sell eggs sometimes complain, while another more favorably situated will be delighted with what he raises. Success depends largely upon the care fowls have, together with favorable surroundings. I have an uncle who formerly lived near Lowell. He is a machinist and went to his work daily, in Lowell. He had a small farm of only about ten acres and kept about five hundred hens, Brahmas and Leghorns, or a cross of the two, and made usually $1,000 yearly from the sale of eggs, (more than he earned at his trade). He raised his own vegetables, had a small garden, and devoted the rest of his land to his fowls, buying nearly all of their food. He sold his eggs daily to regular customers at an advance of five cents per dozen over the market price of hap-hazard eggs. He afterwards went to Wisconsin, bought a farm of eighty acres from a party who was starving on it. A cold, never failing spring boiled out of the ground near the house, that had only been a hog-wallow. This he had cleaned out, stoned up, and built a milk house over it, stocked his farm with dairy cows and made butter his specialty. In a few years his butter had a reputation and was con-

tracted for at twenty-five cents for six months, and thirty cents the rest of the year, to Chicago parties. He made money each year, while his neighbors each side of him sold their butter for ten to fifteen cents a pound.

The business management of farming or any other industry determines the profit or loss.

I know a man now who has only one cow and supplies two families with butter at thirty-five cents a pound. A neighbor has five cows and sells his milk, carrying it two miles to deliver it to the purchaser, and buys poor butter to use at twenty-five cents a pound. The best of everything, either farm products or manufactured goods always command a much greater difference in price than there is in the cost of producing. As a rule, the high priced goods pay the best profit and are always scarce in the market.

I could name a party who had, before the first of March, orders for all the eggs he dared promise this spring, at $5.00 per dozen, and it is true it costs no more to feed hens that lay those eggs than it does to feed hens laying eggs at twenty-five cents a dozen, and they lay no more of them, perhaps, yet those hens would sell for twenty times as much as the others to the man who bought them for breeding or exhibition. "A hen is a hen," and "a horse is a horse," but different specimens have different values for certain purposes.

A man can buy a horse for $200, that is perhaps the best he could get at any price for a coal yard; another will pay $20,000 for a smaller one that can trot a mile in 2.10. The coal man thinks the other is a fool, but let him have a wife or child at the point of death and its doctor ten miles away, and he would give his whole coal yard for the use of that 2 10 horse for one hour.

In the early days of exhibition, judges awarded prizes according to their personal fancy. Now we have a standard to breed to and judge by, and it is no easy matter for a judge to misplace an award. All defects must be recorded on score cards, and the specimens must correspond with the cards. No one variety is best for all persons, all are good and best when best taken care of.

When you hear a man assert that his specialty is the only desirable one for all, it is safe to say, in the language of the late Artemus Ward, he is a "mercenary cuss," and chicken dealer, not a true fancier. I have always been a stickler for thoroughbred fowls *for myself*, but if one cares only for meat and eggs there are cross-bred fowls that are fully equal to any thoroughbred, notably, a cross of Wyandotte cock on Plymouth Rock hens; in fact, I think this cross lays more eggs or more value in eggs than any fowl I ever saw. A White Leghorn cock on Light Brahma hens makes a splendid fowl for all the year round laying, but it would cross thoroughbreds every time. Breeding grades is not satisfactory in results.

The superiority of our modern improved poultry is admitted, I think, by all. The same weights of poultry and same number of eggs can be produced for much less cost of labor and feed now than years ago, on account of the infusion of blood of the Asiatic varieties. Poultry is in greater demand and brings higher prices now than it did thirty years ago and pays a handsome profit to producers.

I recall forty years ago the first Shanghais I ever saw. They were long legged, coarse fowls of no uniform color, but could uniformly eat off a flour barrel. That was the most that was claimed for them then.

There has been much discussion concerning the origin of our modern Brahmas and Cochins. It is of but little consequence what our fowls *came from*, what is of most importance to us is what comes from the fowls we have now.

In this country we are not so much interested in who a man's grandfather *was* as we are to know what kind of a citizen the old man's grandson *is*.

I am a believer in pedigree if it is backed up by a good specimen, but a poor fowl with a good pedigree is not what I want. Some of the meanest men I know were bad boys of good parents. Darwin says our ancestors were monkies.

Beecher says he don't care if they were, and says if it is true, both have something to be proud of. We, that we have progressed to what we are from such a start, and the monkey can point with pride to man

as an example of what the stock will produce under favorable selection and cultivation. I sometimes think perhaps the monkey theory may be true; that possibly long enough ago men had tails, but they had *sat on them* so much in idleness that they wore them off, and finally a sport cropped out without a tail, like a rumpless fowl, and by selection of breeding stock the tailless race became established. Occasionally we see traits in men that lead us to wish they had been more successful in stamping out some other qualities and paid less attention to the tail.

I have never used incubators, but have learned much from observation, which is often as valuable as experience and costs very much less sometimes. A quiet old hen is good enough for me. All the chickens that I have raised on the orphan asylum plan had a tired, short waisted, kicked-up-in-a-heap sort of look that excited pity rather than admiration, and I have seen lots of them. No doubt chickens can be hatched in incubators, but the difficulty is in raising them. I have seen hundreds so raised, and the observation was enough without the experience.

A baby can be made to live on a bottle, or a calf learn to suck a rag soaked with skimmed milk, but such specimens seldom win prizes at a baby show or county fair. If there is anybody here who was raised on a bottle I don't mean him. The man who can artificially beat an honest old hen is a rare exception, and anybody who wants to buy an incubator can find parties who have them for sale that have been "but little used." I am aware that there are many who advocate them, and possibly they may be desirable in the hands of an expert; but for the ordinary breeder they have so far not been a success.

Many complain of the prices charged for improved poultry, but those who care only for meat and eggs can often obtain equally as large, vigorous and prolific stock slightly faulty only in plumage, from our best breeders at nominal prices. Those who pay the highest prices are brother fanciers who pay for exhibition excellence I have occasionally sold specimens for round prices, and anybody who has ever imported knows what it costs to keep up our stock in that way.

We all need to cultivate more fraternal feelings. Men who are

breeding the same varieties would make better progress by working together, instead of calling each other frauds and other hard names.

Many think it an admission that another has superior stock to buy a specimen or eggs from him, a mistaken idea entirely. I may have a bird possessing in a marked degree some point that would be valuable to friend Williams, and he have one that would be as valuable to me in some other particular. When either of us think so we do not hesitate to purchase what we want, if we can get it. I have purchased birds from Mr. Williams and he has purchased birds from me, and neither has considered it any humiliation. I certainly have been satisfied with selections that I have made from his flocks and trust he has had the same experience.

No man can give an infallible rule for mating breeding. It is always safe to add a male bird from a yard that is superior to our own, but the man who raises the birds ought to be better able to mate his own than any stranger can be. Men have different theories for producing the same results, for instance, a strain of any variety having dark bay eyes, dark beaks, dark toe-nails, must be much lighter in under color of plumage to produce the same results than a bird with pearl eyes, light colored beak, &c. This is particularly true of Light or Dark Brahmas, Plymouth Rocks and Wyandottes.

Much complaint is made of extra charges on live fowls. I do not think they are so very exorbitant. The fowls require, and usually get, extra care, are watered and carefully handled. I have shipped hundreds of fowls and never had but one that failed to reach its destination safely. That was a case of four fowls sent to Oregon, via California. Three weeks on the road and one hen died, but I never blamed the express company.

In some places thieves have made sad havoc with poultry. One or two dogs with *instructive tongues* to give timely warning, *attentive ears* and a charge of buckshot well directed, is the best remedy I can recommend. I once heard of an old darkey who had been very sick, but got a little better and wanted some chicken broth, his wife told their boy to go down to the market and buy a chicken, the old man heard

her and called the boy to his bedside and told him not to do it, said it would cause more talk than a church scandal, nobody ever heard of a "culled pusson" buying a chicken in the dark of the moon, and told the boy to go out in the darkness and obtain the chicken in the usual way. The boy had never been on a committee of that kind and having fears of dogs and shot guns before his eyes, or behind his back, desired to "arbitrate," and asked the old man if he didn't think if he prayed for it the Lord would send him a chicken. He said no, not so long as he was sick abed. He had tried that and always noticed that when he prayed the Lord to send him a chicken it never came, but when he prayed the Lord to send this old nigger out into the darkness after a chicken the chicken was always there before daylight next morning.

Of course the farmer who can give his fowls unlimited range has an advantage over us in town who have only small lots. Yet nearly every one with a little extra care can keep a dozen or twenty in quite limited quarters by furnishing them daily with a little meat and an hour's run on the lawn for grass. Such a flock would furnish any family all the eggs they needed. Many of the best birds in England are raised in small yards, the same is true in this country.

One of the best ways to promote an interest in poultry is to organize a local society, and as far as possible have each member breed different varieties, each making a specialty of some one kind. In this way they would work more in harmony, avoiding little jealousies, all trying to make the society as a whole strong in all varieties, or when more than one breeds the same kind have different strains. Then the man whose stock each had would feel pride in his customer's success, and see that he had good birds. Hold exhibitions often, employ only judges known to be capable, honest, and fearless, and you will cultivate an interest that will be a great credit to the Rhode Island Society for the Encouragement of Domestic Industry.

LISTENER. I would like to ask a question in reference to the mating of fowls—whether the same results in either case are ob-

tainable. For instance, take a Light Brahma fowl and mate it with a White Leghorn rooster, or, vice-versa, take a White Leghorn and mate it with a Light Brahma rooster,—are the results in each case the same?

MR. MANSFIELD. I think that mating a Light Leghorn cockerel with a Light Brahma hen will produce larger offspring than mating a Light Brahma cock to a White Leghorn hen. It is true of all stock that they get the size more from the female than the male. That is what I meant by what I said. It is so with poultry. Those who have had more experience in other stock can tell more about that than I.

LISTENER. I would like to ask the gentleman's opinion of what would be the best breed to cross the Buff Cochin. I have about thirty, and they haven't laid. I supposed it took about ten months before they began to lay. Perhaps it has been because of the feed. I noticed very little corn is recommended,—now, we have given a great deal of corn. I just want to ask what you thought would be the best cross for the Buff Cochin.

MR. WILLIAMS. I am almost sorry to be obliged to answer the gentleman's question in regard to the Buff Cochin. They are certainly a very beautiful bird to look at. I admire them very much and I have raised them for a great many years because of their beauty, but I never should raise them to produce eggs. They are slow growers, and will not lay as soon. They would be two months later in laying than the Light Brahma or Plymouth Rock. For instance, a Light Brahma will lay at six months old, and the Buff Cochin will lay at eight. But I would not condemn the breed on that account, because I think we can make improvements in the Buff Cochin, just as we have in the Light Brahmas. A few years ago our Light Brahmas were great setters, and people objected to them on that account, because they had an inclination to set so much; but within a year I had a letter from a gentleman who says,

"Are your Light Brahmas non-setters? The breed that I purchased of you a year ago have not wanted to set at all." Now the reason of that is that we have been taking pains with our Brahmas and breeding for those only who are good layers. I know one man that won't keep a breed on his place that wants to set; if he has one that wants to set he will sell them. Now, the result of that in a few years will be that hé will have the Light Brahmas laying as well as the Leghorns; they won't want to incubate at all.

LISTENER. I would say, when we got the breed it was more fancy than otherwise. We didn't look for a great many eggs. Would it be worth while to keep that brood and get a cross for them? Would it be profitable to get another kind and keep these still? You refer to the Dark Brahmas,—I have had Dark Brahmas that wanted to set as much as the Buff Cochins.

MR. WILLIAMS. Well, if the gentleman wishes to raise them for poultry and eggs solely, I would get a Leghorn cockerel and breed with the Buff Cochins, and you will find you have a breed that will be profitable,—White Leghorn with the Buff Cochin.

MR. HENRY T. BROWN. I would like to ask the height of your house—you said it was 25x18.

MR. WILLIAMS. I would have 10-foot posts, if I could afford them.

MR. BROWN. Would you rather have them low down?—not too high or too deep?

MR. WILLIAMS. I think the better air you have in your poultry house the healthier your birds will keep.

MR. BROWN. You get that by ventilation either from top or bottom?

MR. WILLIAMS. From top and bottom both.

MR. BROWN. My idea was in regard to the temperature of the house at night. If you have glass fronts—after the sun sets at four o'clock, say, in winter—what is the temperature of your house at nine, ten or twelve o'clock at night?

Mr. Williams. I don't know as I could hardly tell you. The house being fifteen feet wide, the sun does not strike clear across the house. There are two other reasons besides those I have said. I don't think it is well to have the house or the hennery so small that the sun will make it extremely warm in the daytime and then extremely cold at night; and by having it fifteen feet wide it won't be apt to heat up the whole house as much as if it were narrower.

Mr. Brown. I have a house perhaps sixty feet long, with a sash running within twelve inches of the ground—about eight feet. It gets very warm in the afternoon in the winter, but after the sun goes down it cools off very much, I think. That is one reason, perhaps, why I don't get the results I ought to.

Mr. Williams. Does the water freeze very hard there?

Mr. Brown. No, sir, it does not freeze in the house.

Mr. Williams. I should say you had a very good house.

Mr. Brown. The question was whether I don't have too much glass,—whether I hadn't better board up some of the glass. It is an entire glass front sixty feet long.

Mr. Williams. People differ very much in that respect. I wouldn't like to ask a person to adopt my theory or my judgment, because I might possibly not be right. But still I should recommend the common window sashes—I mean frames with two sashes, 8x10 glass—because I have an idea that too much heat isn't essential, whether it is good or not.

Mr. Brown. I had a fancy that perhaps the house was too big or too high—that it needed a lower house, maybe six feet in front; and a shorter sash might keep a more even temperature in the winter.

Mr. Williams. All the precaution we can take, all we can do to insure health and to have fresh air, etc., is well expended, I think, because most certainly we love to prevent disease and ailments among our animals. We believe a pound of prevention is worth a

good many pounds of cure. We had better not have any trouble if we can possibly avoid it by taking good care and having our buildings properly ventilated, even if it costs a little more to start with. We had better have posts high enough and room enough. I think we would be repaid in the end by having our stock kept in good health.

Mr. Brown. The cost of such a house isn't very much advanced by the height. I suppose the temperature will be governed by the number of fowls in it somewhat. I keep about ninety in my sixty-foot house, divided into five apartments with wire.

Mr. Louis Winsor. I would like to make a suggestion. I have noticed that fowls need to be aired. I use them just as I use hot-beds. On a sunny day I open the windows and give them all the fresh air going. Then the difference in the temperature isn't so great from night till morning or from after noon till midnight. I think fowls flourish on it. I have noticed in mid-winter they have a good healthy look—their combs are red, and they lay better under such treatment. I have kept hens in inferior quarters and got good results in eggs, when you would scarcely think a nest would flourish, and they came out extra fine in the spring. Of course, in cold cloudy days I take care they have air enough, but I air them out on sunny days—I don't think fowls can have too much. You can hurt them by change in the temperature. I don't think it is healthy for fowls or any other animals—it is always depressing.

Mr. Hopkins. How high do you recommend the building of roosts from the ground?

Mr. Williams. I said two or two and a-half feet, but I had in mind then large-sized fowls. For a small breed like Leghorns or Houdans I would have them higher. My idea is to have this platform that I spoke of, and roosts on the platform, so that the whole ground floor can be utilized. In our winters we have a good

deal of snow on the ground and it is impossible for them to go out. If we have a large ground floor we can throw a little wheat into it occasionally, on the sand and on the floor, and it serves to keep them busy, keeps them out of mischief, and they will lay better.

MR. BURLINGAME. How wide would you have the platform ?

MR. WILLIAMS. About three feet. If you keep Leghorns you could have two roosts ; if you had Light Brahmas, very large, you would have but one. You might arrange them to conform to the size of your fowls. If you have a good many, you see you want more roost room. You might make your platform a little wider, and have roosts running the whole length of the house. If heavy fowls were kept, I would have my perches three or three and a-half feet, of spruce joints.

MR. SMITH. Mr. Williams, have I made a mistake in making a platform twenty inches wide for Brahmas ?

MR. WILLIAMS. I think it is rather narrow, sir.

MR. BURLINGAME. In reference to small houses, I see that the books recommend having small portable houses that can be carried round on different parts of the farm,—fifteen, twenty or thirty hens in each one. What do you think of that plan ?

MR. WILLIAMS. It is an excellent plan, but my idea was that very few people are so situated that they could afford that. I well remember, about twenty years ago, visiting the place, in Stoughton, of Mr. Drake, the originator of the Plymouth Rocks. I was struck very favorably by his arrangements. The dwelling-house was on the hill, the land sloping to the south. I should think an eighth of a mile from the house was a grove of small pine trees. And all over that farm he had little houses with perhaps six to ten hens and a rooster in them ; and there he bred his fowls. They were so far apart that they never came together. He had some way down in this piece of woods. I said, " Don't these birds ever go to the house ?" He said, " No, they don't know anything about the

house." They stayed right around there, and the roosters never got together to fight. And in that way he would have a chance to try different colors, etc., and try to improve his Plymouth Rocks. It is a splendid idea, if one has the land, so that they can afford to have small houses and a small number of hens.

MR. BURLINGAME. How about putting them into the corn fields and potato fields where potatoes and corn are growing?

MR. WILLIAMS. I don't know enough about that to say,—I haven't had any experience in that direction. I should rather put them on a lot after the grass had been mowed, where there is plenty of grasshoppers. That is one of the best things for growing chickens—grasshoppers.

MR. J. M. SPENCER. You would have the nests under the platform?

MR. WILLIAMS. Yes, I would. I don't recommend having the rests fastened to the house at all. I would have this platform two and a-half feet from the floor. You would have a great many large hens that cannot fly up; and so to assist them I have a long box, perhaps ten feet, with apartments, and have it opened from the back side. They go in and lay on the back side. I have a lid in front to drop down. I have several reasons for that;—one is to keep it off from the platform a little way, so that the large hens can fly up on that and then on the platform; and they have to go into the back side to lay. The front is closed up, because when fowls are kept confined in cold weather and have nothing to do, they oftentimes get to eating their eggs. If you have their nests a little secluded, you can prevent that—they cannot see the egg. But if you have it right before them all the time, they will go up and begin to pull it over—perhaps not meaning any mischief at first; bye and bye they break it, and in that way they learn to eat eggs.

MR. SMITH. What is the objection to making this platform lower?

Mr. Williams. We want to utilize the room on the floor; and if you have it too low, if one gets under and you want to catch it, it will take you a good while. That often annoys me.

Mr. Smith. That is the only reason?

Mr. Williams. Yes, sir.

Listener. I would like to relate a little experience I have had during the past winter in building hens' nests. It has been recommended by all poultry fanciers to build a platform as Mr. Williams has recommended, with the nests underneath—with a board tipped down to take out the eggs. I arranged my hennery that way this winter. When the hens began to lay I found eggs dropped all over the ground, on the outside and under the roosts. I couldn't coax them into these nests any way, so I took the box and nailed it up about three feet from the ground on the side of the hen house, and they have laid in those boxes ever since. I never have gotten eggs out of the nests underneath the roosts. I fancy they had rather fly up a little distance into the nests than to go in those boxes underneath the roosts.

Mr. Winsor. I would like to inquire what breed the gentleman keeps?

Listener. Light Brahmas and Wyandottes,—they both laid in the same manner.

Listener. I always noticed the smaller breeds like the Wyandottes and Leghorns like to get up high to lay.

Mr. Williams. If I kept small birds I would build some boxes up higher, so that they can gratify their desire to fly up and lay in the boxes. I don't think the Leghorn loves to lay in the boxes on the ground, and perhaps not the Wyandottes.

Mr. Winsor. Don't you think it is so with breeds of non-setters? I think the fowls that set the most persistently set on the ground; they prefer it—it is natural they should do so.

Mr. Williams. All the smaller birds love to get up high to lay.

LISTENER. From your experience what do you consider the better ventilation—from the bottom or top?

MR. WILLIAMS. I said I hadn't studied the matter sufficiently to give an intelligent answer. I have both,—I thought I would be sure and be right. I know several gentlemen that have adopted it, and they tell me it works admirably. I know I had one house last winter about fifty feet long, fifteen wide, and ten-foot posts, and I was troubled all winter and had been for two years with colds and roup, if I didn't take care of them. This last summer I had two ventilators put into that house from the bottom and top, and they have certainly done a great deal better than they did the year before and the year before that. The top ventilators were about six inches square—two of them on the house fifty feet long.

LISTENER. Do the ventilators open out doors, or pass up through the roof?

MR. WILLIAMS. Up through the roof, and tight all the way down till you get within one foot of the floor, and then open.

LISTENER. I would like to say, in my house where I had top ventilation the water froze. I thought I would ask you, as you had more experience than I.

MR. WILLIAMS. I never used bottom ventilation till this last winter.

MR. DAVIS. Which do you consider the best kind of roof—shed roof or peaked roof?

MR. WILLIAMS. A regular house roof. It is almost impossible to have a shed roof tight. You can't put on shingles to keep out the water.

LISTENER. How about lining? How do you build the walls?

MR. WILLIAMS. A great many recommend tarred paper. I presume it is first-rate. I never have been very particular about having my houses extremely warm; and one of the most healthy houses I have is made of spruce boards battened over the cracks.

LISTENER. Don't you mind the water freezing?

Mr. Williams. It will freeze in the very coldest weather, but that house is about as warm as this one I spoke of—fifty feet long and twelve-foot posts, clapboarded and shingled, and made just the same as I make a house to reside in. There is one thing I neglected to speak of, and that is the floor of a poultry house. My idea has always been that if we could have it set on a comparatively dry spot, that we had better not have any floor, but if I could afford it, as I said several times, I would cement the bottom and walls up to the sills, and then put in about four to six inches of sand that won't tread, but always be loose—and I find in the winter time, when the sun shines into the houses, that the fowls have a splendid time dusting and rolling in that sand, and it must be conducive to health and prevent vermin from staying on them. The fact is, I always thought they enjoyed it, and I haven't got a house on my place that has any floor—they all have that sand bottom. I take pains to get the sand in the summer time, have it get good and dry, put it in in the summer, and then it keeps dry all winter.

Listener. Of course, Mr. Williams wouldn't recommend a cement floor unless covered with something?

Mr. Williams. I recommended the cement to keep the rats off. I never finish up. I mean a good deal more than I say.

Mr. Smith. A gentleman wished me to tell what he could do with fowls. He says the product of twenty-six Light Brahma fowls was as follows:

In January, 1886,	from	26 hens	in	31	days,	314	eggs.
February,	"	"	"	28	"	389	"
March,	"	"	"	17	"	295	"

The greatest number in any one day, 21; on March 8, 12 and 13, each day, 20,—averaging in January, 10 eggs per day; in February, 14; and March, over 17. I will also read a portion of a letter from a practical egg producer:

"I received a letter from a friend who had kept poultry most of his time without success. He said he had about one hundred hens; but did not receive many eggs. In the summer his coop is full of insects. Last summer he set about ten hens with fifteen eggs each, getting from some one chicken—some ten chickens, and some hens left the nest. So he was sick of the hen business, he said. I went to his place to see the cause (he is not the only one fixed this way). When he set his hens he would take an old flour barrel, fill it with dry hay, put fifteen eggs in and put it on the ground in the heat of the sun; in less than a week the hen was driven from her nest with insects, or the eggs were all ruined with the heat of the sun. I told him I would just teach him how to manage fowls. I made him a present of fifteen Leghorn eggs, told him to get a box, put in it half a pail of damp sand, get any kind of green grass and make a round nest, then put in the eggs and the hen, and put it in the dampest and darkest cellar, with corn and water, with just light enough to eat by. He did so, and the result was he got fifteen strong, healthy chickens. If hens are set in this way every good egg will hatch and be a stronger chicken than in any other way. For keeping fowls and having them lay winter and summer don't have any boarded bottom to your hen coop, but have sand four to five feet deep like a cellar. I put a little ground ginger in the water both summer and winter, and then there will be no trouble whatever with them. One hundred hens kept in this way will reap quite a little fortune in a short time."

MR. MANSFIELD. I think the gentleman that has so much trouble with lousey houses has probably got a lousey hat. I would be as much surprised to find my poultry houses lousey as my hat. I agree to give any man a dollar apiece for every louse he can find in my houses. I have made that statement before, and it has been tried, but they never got one. I whitewash it perhaps twice a year and keep it scrupulously clean and dry, and that covers all the trouble. A damp fowl-house will breed lice if they have half a chance, but if you keep it perfectly dry you cannot have it lousey;

and you find a hen-house where the dust has settled all around-and thereis no lice there; but if damp—no dust there—the damp, ness settles on the wall, and they are always sure to be lousey. If you catch a hen you will find a little grey body louse, very rapid in its movements; but the kind you have trouble with is the kind that infest a house and the perches.

LISTENER. I would like to relate a little of my experience in setting hens. I have used old bedding of horses for making a nest and I find it is an excellent preventative against vermin for hens that are setting.

After a vote of thanks the meeting was adjourned.

TENTH LECTURE.

The last of the series of farmers' meetings was held at the rooms of the R. I. Society for the Encouragement of Domestic Industry, March 25th, 1886. Mr. Peckham presided, and introduced the speaker of the afternoon, Mr. Edward Burnett, President of Massachusetts Agricultural Society, who had chosen for his subject "The Channel Islands, Cattle and the Farmers."

MR. BURNETT'S ADDRESS.

Gentlemen and Fellow Farmers:—I have no notes. I have written several papers on this subject and am more or less familiar with it. I shall be delighted to have you all interrupt me and ask questions if I touch upon a point and do not give detail enough. I am chock full of detail as far as the Channel Islands are concerned, and can probably answer your questions.

The Channel Islands really belong to France, but they are under English government. They are only ten or twelve miles from France, off the coast of Brittany and Normandy.

These islands lie southwest of England. They are approached in two or three different ways. The most common way of going there is to take a small steamer at midnight at Southampton, England. It is a very rough passage, I assure you. I have crossed the English Channel at that particular spot a good many times and I have never seen anything like it in a dozen trips across the Atlantic. The steamers are of iron,—very short, heavy boats built for heavy weather,—and yet

are like a mere cockle shell, provided the elements are let loose. You start, as I say, at midnight, if it is during the tourists' season from the first of June to the first of October. You are very crowded inside. And whether you take a first or second class ticket you are piled into the first cabin and allowed a space of about eighteen inches by six feet. One man has his feet at your head and another man has his head at your feet, and I assure you if it is rough and they are feeling the influence of the roughness it is very disagreeable. But you approach these islands early in the morning.

Guernsey lies about one hundred and twenty-five miles from the coast of England. The first approach to land is a group of ledges called The Cascades. These lie about sixty or seventy miles from the coast of England. They are about one-half a mile wide at low tide and a mile and a half long. They are entirely covered by water at high tide. And on these ledges are three revolving light houses that stand about one hundred feet in height. These ledges, of course, make the approach to the islands very difficult and it requires very good navigators and small, staunch boats to stand all weathers. Frequently the captains of these boats are obliged to lay to twenty-four hours before they can enter the channel. The first of the islands you see is the Island of Alderney. This is a little island containing only about two thousand acres of land, three miles long and only about one mile wide. And let me say here, you older gentlemen are probably familiar with the cattle of the Channel Islands as Alderney cattle.

This really is a misnomer. As you see this little island of two thousand acres is composed almost entirely of rocks and ledges of granite. They run quite a number of schooners to different parts of England to build the macadamized roads, and also loaded with large blocks of building granite. But the principal feature is its fortress on which the English government, nearly half a century ago spent $15,000,000. It was then, that the Jersey cow was first recognized by means of these officers. The officers in the engineer corps of the army were very much surprised at the flavor and color and richness of the cream and butter they had while stationed at Alderney. These cows were brought

from the neighboring islands of Guernsey and Jersey to supply the immediate wants of the garrison and engineer corps. When they returned to England the married and older ones began to talk about the delicious cream and butter they had while on the island of Alderney, and a demand at once sprang up among English householders, as you find in Boston and New York, for what I call a family cow. And every spring I buy from fifty to one hundred family cows.

I always advise the grey Jersey because it gives splendid cream and milk.

These men made the reputation of the Alderney cow from the island of Jersey, mostly, and for twenty-five years they passed it down, calling the Jersey cows Alderney. It was so in this country till the last ten or fifteen years. You older men will recollect in 1851, or about that period, everybody spoke of those cattle. In the Massachusetts reports I have read of those years,—1853, 1854 and 1855,—they were spoken of as Alderney cattle. I make this explanation to show you it was really a misnomer. They were really Jerseys. I say so much about Alderney,—it is simply a barren island three miles long by one mile wide, and devoted to cutting blocks of granite. And the few inhabitants are either quarrymen or fishermen, and the whole island contains, I think, not more than two hundred head of cattle.

We next come to Guernsey. It lies about fifteen miles from Jersey and is probably the most beautiful. It is three miles long, four or five miles wide, and contains about sixteen thousand acres of land, ten thousand of which are under cultivation. It has a population of about thirty thousand. All these islands lie on the edge of the Gulf Stream. The climate is typical, so to speak, different from France or England. They have a great deal of sunshine,—a most delightful climate,—so much so that many invalids go there from England and regain their health in a few months. In the months of October, November and December, they have about thirty-five inches of rain. And one very peculiar feature is, that it almost always rains at night or early morning, so you can count on having your drive in the afternoon. The approach to Guernsey is through a most expensive and elaborate harbor.

They have spent on the island of Jersey $17,000,000 on their harbor, which embraces about fifteen acres. And the island of Guernsey has a harbor just as elaborate, just as thoroughly built, and I assure you, gentlemen, it does an American good to go there and see how splendidly they do their work.

The great and enormous blocks of granite tied together with iron. The quay, wide enough for three or four teams to go abreast, and extending out three-fourths of a mile into the sea.

They have a land locked harbor, so to speak, made so by artificial means, mortar and granite. Inside this harbor it is like a big lake two hundred feet in width, a mill-pond, whereas just off the end of the quay it will be as rough as any part of the Atlantic, as these islands lie right in the Atlantic, so to speak. The tides here, as you all know, fall and rise to a greater height than any other place in the world. About forty feet is the mean tide. Thirty on the island of Guernsey. Guernsey is called the most beautiful island of the group. Its climate is quite different from that of Jersey. It has about sixty varieties more of semi-tropical plants, and the foliage is something wonderful. They have an evergreen having a leaf something like an ivy leaf, dark, brilliant, rich, glossy green. And you find right down to the water's edge the most beautiful stretches of grass, it grows most luxuriantly here and grows very fine. I suppose there is no spot on the globe where farming is carried on to such an extent as on these islands.

Just look at it, gentlemen! On the island of Jersey, with forty-five square miles and sixty thousand inhabitants, they sell, besides supporting themselves, $1,500,000 worth of food product annually. This island of Guernsey has an entirely different type of cattle from the Jersey. I am told one hundred years ago the cattle on the different islands were very much alike, but to-day, they are as distinct as the Holstein and the Ayrshire, and just about the same difference in size.

I think one of the best illustrations is shown in breeding to the winner or not breeding to the winner. On the island of Jersey the prize bulls have had all the service. On Guernsey it is simply a matter of where you can get the cheapest service. If you have an order to buy

twelve or fifteen Guernsey heifers you go all around before you are satisfied, and then you come away not altogether satisfied. It is almost impossible to find in a herd of Guernseys,—and there are rarely over five or six, yearlings and calves,—out of the whole bunch you won't find more than one or two that have got udders that will fill your eye perfectly, and they have got a big, coarse carcass.

I take off my hat to every typical dairy cow, and you find them occasionally on the island of Guernsey. They are really bred with no discrimination, no care. The island of Guernsey makes the best butter, and that is easily explained, because to-day the island of Jersey gets five tourists where Guernsey gets one, and the surplus on Guernsey goes into butter. On the island of Jersey four or five months in the year they have no surplus, they can hardly supply the demand for new milk. Hotels are scattered all over the island. An immense number of tourists flock in there during the months from June to October. They don't make a great deal of butter on the island of Jersey, and what they do make is not first-class. Of course, occasionally you find splendid Jersey butter, but they have not the conveniences; it isn't their business to make butter there—they have a ready sale for all their milk. On the island of Guernsey—and it is undoubtedly so, no question about it in this country—the butter is much deeper and richer in color than on Jersey; but upon close examination and tested under the microscope, it hasn't quite the firmness of the Jersey. I try to speak impartially. I am a Jersey breeder, and I have a great many friends that are Guernsey breeders. A few years ago a gentleman that started out to import Guernseys at that time claimed the Jerseys made not only better, but richer quality of butter, has forgotten all about it now. It is a mistake. There is no butter that has the waxy firmness of the Jersey butter, and I think that any impartial witness will decide in my favor.

I shall not tell you much about the farming on Guernsey, as it is literally the same as on the island of Jersey, but they devote more space and time there to the question, perhaps, and during the last few years it has become an important industry. St. Petersport is the most im-

portant town, and is the town having this harbor I told you about. It is built upon a hill, so that really the houses are built one right on top of another. And if you ascend, no vehicle can ascend the streets there if they go right up from the shore, they have to wind around, the hill is so steep at St. Petersport. It is the home of Victor Hugo, and I think one of the most interesting novels I ever read is "The Toilers of the Sea," in which the scene was laid in the island of Guernsey. It is well worth reading. It gives you a vivid description of the island. They raise here an immense number of vegetables under glass, which they send to London. The demand for every luxury there is very great. Somebody has said "There is nothing that you cannot get in London." You can get new potatoes almost any month in the year, and almost all of them come from Guernsey. And you will find houses devoted to potatoes. And after the potato crop comes along, up spring a few tomato plants. They run their tomato plants to death. You will find tomato vines that have been bearing nearly two years. They cover the whole side of the house with them. They don't take the pains with their tomatoes that we do. They raise the old-fashioned Boston Market, that has the wrinkles and unevenness. They do not get the beauty of form that we have to-day in our Livingstone, Acme and Trophy. They also raise a great number of string beans. There will be a whole house devoted to string beans. The potato crop on these two islands is really the most important crop, and I suppose brings in twice the income of the cattle, strange as it may seem. This crop is planted about the first of February, and is matured early in June. Their land has become adapted to the potato. They use a great deal of sea kelp and an immense amount of artificial manure.

On this little island of Guernsey you find about six or seven thousand cattle, and you see the manure from these animals amounts to a great deal. They buy more artificial manure than in any spot in England, and in the winter they are hauling sea kelp from the different beaches all the time. I think this land produces more to the acre than any land in the world. They get for their first crop five or

six hundred bushels to the acre, frequently. Their land is so adapted and fed for potatoes that right on top of the first crop they apply more artificial manure and plant a second crop, which will amount to two-thirds or three-fourths as much as the first. These potatoes bring as high as ten shillings a bushel in the London market, when English potatoes will not bring more than seven or eight.

This potato crop is carried on most extensively on Jersey. They will give a rent as high as $200 or $300 for an acre, for a year, for potatoes. This gives the impression that they are wild over there, but it is a very good investment, I assure you. This little space of land does not comprise a large area, it is only half an acre here and there, which has been noted for years for producing the earliest crop of potatoes. And if a man has that piece of land the chances are almost certain that he will get potatoes from ten days to a fortnight before any of his neighbors, and what does that mean in the English market? It means the same as any luxury which comes into the market first,—double the price; and therefore he will get for his four or five hundred bushels of potatoes, $1,100 or $1,200. Now, talking about potatoes, they have instituted an entirely new system of planting potatoes there during the last ten years. This was brought about by accident. My friend, Mr. Dorey, the Secretary of the Royal Agricultural Society, and a charming man, married a French wife. Ten or twelve years ago he was obliged to visit France with his wife, just before the planting in January. Her father was sick and died; the reading of the will, &c., kept Mr. Dorey in France until after they had begun to plant their potatoes in Jersey. Mr. Dorey has a farm of six acres and eight head of cattle, and raises from $1,000 to $2,000 worth of potatoes a year.

I have told you all along there is no farming like this on the Channel Islands. Mr. Dorey, on his return, found his neighbors Le Brocq, Alexander, Nicol and other prominent French farmers there, who had devoted their lives to the potato culture, and whom we consider the foremost men, had got their potatoes in the ground, and just beginning to prick through the surface. He was perfectly discouraged. He had only half an acre ready, but he decided to plant that half acre himself.

Almost all the labor there is peasant labor—women who come from France. They hire them there instead of men.

Mr. Dorey, with his two peasant women, went out into this half acre of land and instead of sprouting these potatoes, rubbed the sprouts off; he took a great deal of pains to select those sprouts which had a top grown on them and the eyes themselves; he planted these potatoes as you would plant geranium or pink slips—each by itself. They plant their potatoes very closely there, set them only about ten inches apart, and rows about twenty or twenty-five inches apart in width. It was an experiment, but he made up his mind he must be even with Alexander and Nichol and Le Brocq. The result was Mr. Dorey, that year, from that half acre got $6 a bushel for his potatoes, and his potatoes were ten days ahead of all these other men, who had planted ten days ahead of him. Mr. Dorey's call to France revolutionized the whole system of potato planting in Jersey. And to-day you will find on every farm, in the fall, put by in some warm place, an outdoor kitchen or woodshed, large boxes of potatoes like peach crates. They fill them four or five inches deep and allow them to sprout—to "spindle up stubbed," as my friend William Crouch said of a fat boy. And in that way, to-day, all the first crop of potatoes is put in, at a gain of about twenty days over the old system. The crops are magnificent and the field is wonderfully clean, like a model garden. It is exquisite to watch the culture of these potato fields. Why, a weed an inch long would disgrace a man. All their cultivation is done by women. I assure you it rather shocks an American—carries him back to the days of slavery, to see a woman harnessed into a cultivator—but they do it most cheerfully. They have fine physiques, of course, working out of doors. There is something very picturesque in seeing one of them working upon some southern exposure on a hillside. They dress in some coarse material, but they always have a bright, I believe they call it, a bodice or waist, and they have a very neat white cap with two strings that go out behind, and they wear over the shoulders a little colored shawl—a different color from the bodice—and they blend these colors so they always look very picturesque. They have dark eyes and the most beau-

tiful complexions, strange as it may seem. They have most wonderful complexions. The artists there are crazy over them. They sit for them as models. These women cultivate potatoes, taking turns in using what we would call a garden cultivator, with two straps over the back. You will see a peasant woman walking along and another woman holding the handles. Then they go back after having cultivated the piece, and with a little piece of iron work in among these potatoes and leave them in a most beautiful shape. It is this strenuous cultivation and high manuring that enables the island of Jersey, with forty-five square miles, to support sixty thousand people and send away every year from $1,500,000 to $2,000,000 worth of food products. That is the whole secret.

The island of Guernsey we now leave because I want to talk to you more about the Jersey cattle and farmers, with which I am more familiar. Jersey lies about twenty miles from Guernsey, and we approach it from the south side. Another of these enormous harbors was built here at a cost of about $17,000,000. And by means of an opening hardly one hundred feet wide you are shut into this placid body of water, and there you are tied up on one side to this dock, which covers over seventeen acres. It is very funny, the immense rise and fall of the tide. For instance, when you get there at low tide, the impression that the docks give you is simply enormous; you realize the immense cost and labor it must have been to build it. You land on the third or fourth story, way down on the ground, and then you climb up a series of stairs. At high tide you don't get the impression of this immense granite structure because then you simply walk off of the steamer on top of the quay, and I think here it would be impossible to land passengers and baggage unless you had some such means of going up and down. Whenever a vessel is docked, she is docked up side of a series of platforms, one or the other, and you walk off any one that the tide may happen to suit. St. Helier is a queer city, it contains about half the inhabitants of Jersey,—about sixty thousand inhabitants, forty-five square miles and about twenty-nine thousand acres. Twenty thousand acres are under cultivation, a high state of cultiva-

tion. St. Helier is very peculiar. It is a queer little town, with narrow streets, and through the business parts of the city only one vehicle can go at a time. About every two hundred feet you have a little turnout. When the drivers get into a fight, get locked, it is a question for the police to settle, because they cannot pass each other unless they get into one of these turnouts. This brings out one of the laws of the island; they are different from those of any other place. They are free traders, and cologne water that costs $1 a quart in England, owing to the excessive duties on spirits, you can purchase in Guernsey or Jersey for about twenty-five cents, and the result is that some parts of St. Helier are devoted entirely to the manufacture of cologne. They are more rigid in their examination of baggage coming from the Channel Islands than they are at Liverpool when you come from America. All those tourists that go to Jersey, are generally clerks in banks or stores, men of moderate means, that get about two weeks' pleasure for $15 or $20, and they are able to take home to their wives and sweethearts all the way from a pint to a quart of cologne. I believe the law allows them a pint. The island is very peculiar in another respect also. Embracing only this small area the south and southeastern exposures of the island are very different from the exposed or northwestern part. The most beautiful part to me is the northwestern corner. There the bluffs rise from the sea abruptly one hundred or one hundred and fifty feet, and stretch down towards the southeast. You find there in those parishes little streams having the finest water in the world, all over the island. I think this has a great deal to do with the breeding of cattle and their comparative healthfulness. They never have had any disease whatsoever on the island. You will find the most delightful little lanes, and most wonderful growth of hedges. Now, this island is divided into parishes. St. Helier really means the parish of St. Helier. There are eleven others, St. Mary's, St. Mark's, St. Peter's, St. Clemens, St. Lawrence, are the more prominent ones. These parishes are like towns; they are ruled by a board of selectmen, so to speak. Each parish has a church and school connected with it.

The farming of the island is also conducted on a very different prin-

ciple. You find where they have the best land and raise the best crops, they have, of course, naturally the best farms. You will find on the north and northeastern extremity of the island the poorest farms and the poorest cattle, not nearly as large as those on the southern extremity and the eastern part of the island.

I enjoy my trips to Jersey better than to any spot on the globe. It is simply a paradise, on account of the climate, wonderful beauty and luxuriant foliage. Rhododendrons grow to a height of fifteen or twenty feet. There is no other place in the world where camellias bloom as they do there. You frequently see a farm house of stone, a roof made of red tile, in March covered with camellias in full bloom. Myrtle creeps in among them and when the leaves fall off then the myrtle takes their place, makes a background, so to speak—covers the house from one end to the other. They have a most wonderful climate for these flowers. Geraniums grow there most luxuriantly. You frequently see them from six to ten feet high. Fuchsias also are very common, growing about the roadside like wild flowers. A Jersey lane is something peculiar to the island, something you see in no other spot, probably, in the world. The main roads are kept in a superb condition. There the poor people whom we should send to the poorhouse are simply given two shillings a day to go out there and break stones. No matter whether they break a hatful or two or three bushels, they get their two shillings a day, and they have no poorhouses there. If a man is very old and infirm, they provide him with a little arm chair and a hammer about the size of a carpenter's hammer, with a handle about three feet long. Piled up at the end of these highways are little square pieces of granite about the size of a man's hat, which these old fellows pull out one by one, break up and throw behind them. These lanes diverge at right angles from the main road,—they are simply bowers,—tunnels of foliage, and have been cut to furnish material for the roads, so that they are below the surface of the land some six or seven feet. They have taken evergreen oaks from their hedges there, and with their wild ferns, they form a complete tunnel, the ferns coming down to the edge of the road and the trees meeting overhead, so

you may look through one of these tunnels for quarter of a mile without hardly a break. You will see, perhaps, in driving through one, where the sun strikes through on the opposite bank. It is wonderful to see the exquisite growth of the ferns and foliage, and the great pride that these farmers take in the Jersey lanes.

Now I am coming to my subject, which is the Jersey cattle. The Jersey cow is probably the most thoroughbred animal we have. And I think you will all admit with the Jersey bull the progeny with a common herd of cows, is more strongly marked than any other thoroughbred bull that there is. For instance, you will frequently find among the half breeds, cattle looking enough like thoroughbreds to sell them for thoroughbreds, and I regret to say, I think it is sometimes done. They stamp their progeny indisputable, so that it is impossible for anyone, whether an expert or not, not to discern the Jersey blood in the animal. One reason for that is that this little island is hedged in by such a difficult approach that really you can only enter the island at this one point, and their laws are most stringent, and have been so since 1789. They passed laws fining any one $500 who should bring cattle from France on to the island. And although they have to depend on France for their beef it is killed on the docks, and no animal is driven into the interior for food except a steer or bullock, and they are branded with the government brand, and the hide must be returned within a prescribed time to the officials at the seaport town where the cattle were landed, to prove that the animal has been slain. This is a reason why they get such a strong type of blood. In 1789, the first laws were enacted; in 1834 they really began the breeding of Jersey cattle, which culminated in the importations of Motley, Norton and others. Colonel Le Couteur started the Royal Agricultural Society, and devoted fifteen years of his life to the development and improvement of the Jersey cow. He was a man whose one object was not only to improve the form of the animal, but to breed for butter, and a high scale of points which then were only twenty-seven. Out of the twenty-seven five were for butter progeny, sire and dam of the animal. Well, he did more in fifteen years than any one has since done in thirty years,

on the island. And he completely changed the type of the cow not only in its form but in its butter producing capacity. And I suppose when he retired from this Society, in 1849, the Jersey was at its best. I doubt if it has ever been better, or perhaps as good since. He devoted his whole time to it. He must have been a man of very strong influence; must have had a wonderful power over these farmers.

In 1849 the Royal English Society were the first to recognize the Channel Island cattle by giving them a premium, and after that show they held at Southampton, of course a great many cattle were brought over there and exhibited, and attracted a great deal of attention.

Well, after that the English noblemen all wanted cattle from these islands and wanted animals self-colored, fawns or slate greys, and from that date they gradually did not pay so much attention to the butter ancestry of the bulls as to breeding their squirrel greys and lemon fawns. Well, this hurt the animal. There is no question about it, they lost sight of the main points; they lost sight of what the cow had been bred for for over half a century—the butter qualities.

The first recognized Jerseys were those early importations made in 1851—if you remember, you older gentlemen—about 1850. About the middle of this century there was a great excitement over thoroughbred cattle. Mr. Sam. Thorne, Mr. Sheldon, and a few others. Men talked about the short horns, the Ayrshire cattle and Holsteins. They were not imported in any great quantities, but the Jersey people began to take it up and quite a number of importations were made by New York and Massachusetts gentlemen. The interest in the thoroughbred stock in this country did not really begin till about the year 1850. The Channel Island cattle were now sent here. After Le Couteur had retired from the Secretaryship and this Royal Society had become a great success, the first year, in 1834, their premiums were $75; in 1850, their premiums were $500. They began to breed more for the English market and more for solid colors, slate greys, and lost sight of the butter qualities of the animal, although it had been bred so strong that they did not give out, did not lose it entirely. The gradual change was brought about by the Americans who a few years ago went to the

island. They did not pay so much attention, or pay so much money, for solid color animals as for the old Colonel Le Couteur type of butter animals. About five years ago they started a society to breed these butter animals and keep the records. They have in every parish a large book, and in this book is the record of the famous cows in the parish. For instance, Mr. Alexander or Mr. Le Brocq wants to test a cow, and this is recorded in the book, and on the page of that book is the signature of Mr. Le Brocq. This has to be done before a justice of the peace or notary public, and the whole thing is filed here in form. So you see that the rule now, in breeding Jersey cows on the island, is, they breed for butter, and butter alone, and the result has been most favorable, as shown in the change in their bulls. A bull which formerly was magnificent in shape and form and had taken a prize on the island was bred to always. This prize bull of two years ago was out of a cow, a fair cow, but not a wonderful butter cow, that had sold for $1,500.

There is no question but that we have started the ball in the right direction. There are many who hold that the island cattle are not as good as our American bred cattle, but I simply say this, and I think I am a fair judge, that the average there is higher than it is here. I am not a great believer in pedigree. Unless pedigree is backed up by merit I don't think much of it. I mean by that, that the American breeders have been running on pedigree too strongly, and have paid enormous prices for inferior animals, really because of their pedigree. Now trace the pedigree back a few years and it probably all runs in the same line, and I believe that if you select a bull which has as many butter ancestors behind him as possible, and I believe his dam has the greatest influence on the progeny, and the more perfect her form and udder the more perfectly formed her progeny will be.

The most perfect illustration of that is in the English stud book. This book has been kept for one hundred years, and you find that a wonderful filly that has won the cups has been sired by a wonderful horse. And you find that every wonderful horse had some grand, famous mother. Why should it not apply to the breeding of cattle?

I am not old enough to prove this and back it up by an array of facts that go back, except ten or fifteen years, but I find this a fact from observation and practice, and I have advocated it in Iowa, Pennsylvania, Maryland, and other States. You should judge young bulls by their dams, and old bulls by their progeny; that is the way you would buy a bull, and you should judge him the same way.

Speaking of pounds, it is very funny. There they have one different from what we have. Their pound weighs seventeen and one-half ounces, so when a Jersey cow makes fifteen pounds on the island, it would make sixteen and one-half pounds here. As to the manner of tillage there, the farming is really very crude. You will be astonished when I tell you that most of the farmers plough to-day with a plough that has a wooden moldboard, but iron point. And that plough has a string team on it, and that string team won't be able to plough more than one-half the length of the piece. The plough has to swing and the horse on the plough has to do about two-thirds of all the work. No farmer keeps five or six horses, but they plough each other's land, and have ploughing bees, as we would call them. They plough very deep, and then they have a second ploughing and turn their manure under shallow with one horse. They also have what strikes you as rather peculiar here, they have walls all over the land, this is on account of the value of the land. They surround a piece with an earth wall; raise it three and one-half feet from the surface of the ground, and cultivate and cut the side of this wall, so they don't lose any surface. The hedge is trimmed every year, and the trimmings from this hedge furnish them with all the firewood they use in their kitchens. They have on this island with this immense number of people no wood for kindling, but any quantity of these hedges are trimmed, tied up in faggots and put away into the wood-shed to be used for kindling. They are cultivated just as we should cultivate a field of cabbages and potatoes.

The cattle are very seldom turned loose. They are put on to a piece of land, pasture land, not very highly cultivated, and three or four cows put at one end and they sweep across that field till they have

eaten it just as clean as if swept across as you would with a scythe. So that by the time they get to one end they are ready to begin at the other. This is done in a most economical way. For instance, you would suppose a cow was given a new space every day, but she is allowed about eighteen inches more chain three times a day. For instance, a cow is tethered from a chain fifteen feet in length, the stick is moved on a line parallel with the side of the field eighteen inches, three times a day. She gets a clean swath of eighteen inches, and makes clean work of it before the stick is moved.

The cattle are made great pets of and they teach us a wonderful lesson of what can be done with care. I have often said to gentlemen where I selected a herd of cattle, I may make the best selection/in the the world but if not backed up by care, in three years it will be a very ordinary herd. They teach us the importance of taking the very best care of our young stock. They take a great deal of pains to bring them up by hand, and then the old cows are attached to these women, who treat them very gently. It is charming to see them at night. They go into the fields and without tying the cow sit down beside her on the stool, pull out their big tin can and begin to milk right into it without the cow's paying any attention. If she is eating she may stop, or if lying down she gets up and submits to the process, and remains perfectly quiet till it is over. I think their milking can is one of the most peculiar vessels. It is very picturesque, and in these days of high prices for vases of picturesque shape, would be interesting. It is always the same, a huge globe holding about fourteen quarts. It has a nozzle and a handle, and is really shaped like some of the pitchers I have seen in some of the crockery stores during the last few years.

LISTENER. I would like to ask if the butter quality of the bull is generally found in the head ?

MR. BURNETT. Do you mean the quality of the ear and the skin ? Well, no ; I would rather take my chances of buying a bull out of some famous butter cow that in turn had been sired by a bull out of a famous butter cow, than to take a bull that showed butter in

the head. Do you mean in the eye? I don't know exactly what you do mean. In looking at a cow you sometimes examine the ear to see if the color indicates a rich quality of milk. In selecting a bull I always do that. In Guernsey they have what they call a butter eye, an eye surrounded by a rich golden fluid. I can't describe it exactly. In a bull, as I told you, I think so much more of the parentage of that bull than of any outward indications—I want a bull well made up. I want individual merit backed by a good pedigree and a good dam. I like to see a good cowey head—long. I want to get enough of the masculine type to show it is a bull, but I rather like to see a feminine head.

LISTENER. In rearing calves do they bring them up on the cow?

MR. BURNETT. No, they wean them at the end of forty-eight hours,—bring them up by hand. They teach their calves to feed almost at once. It is very strange, but do you know a calf there only six or seven weeks old will eat chopped up parsnips; and I found from experience since I visited Jersey during the last six or seven years, that I could radically change my method of feeding my calves. I found my calves begin to nibble at oatmeal in three or four weeks and relish it, and in seven or eight weeks they will begin to smell of rowen and nibble at it. I believe you don't want to feed them fattening food. I think it is a mistake, the idea some of the farmers have in Vermont and New Hampshire, that they can neglect the calves and yearlings; and so many times that neglect makes the difference between a good cow and an inferior cow. They have an idea that whatever they can't sell, and whatever their cows don't eat, they can feed to their young stock, and on the strength of that bring out a mighty scraggly lot of heifers. It is better to select three or four heifers from the best cows than to carry this big lot and half feed them. I forgot to tell you that on the island of Jersey almost every farm has attached to it a little grapery for pin-money for the good wife, and they ship quite a

number of tons of Black Hamburg grapes to London every year. They generally ship in August and continue till the last of September. They are the most wonderful grapes in flavor, too. They are apparently raised without much care; but I imagine the woman of the house waters them with slops and takes great care of them. They have a little lean-to called the grapery. They have another funny custom on the island which would be a great temptation to some men. The moment you purchase an animal of a man you must go into the house and break bread with him and take a glass of wine. Well, if you are after a herd and begin at half-past six in the morning, it's rather hard. They bring out four or five kinds —cognac brandy, schnapps or gin, port wine and sherry; and if you don't partake of their hospitality they feel hurt, and I often found it disagreeable. I said at once, although I am not exactly a teetotaller, that it would be impossible for me to drink wine before breakfast. They asked me if I would take a glass of milk with them, and I said I would with pleasure; and although I am not much of a milk drinker, I took it with a nice piece of their cake, and it was very good indeed—just the kind I like—dark cake with raisins and citron in it; it would keep six or seven months—you just want to taste it! I found out afterwards it was considered just as good if I took a bunch of grapes; and frequently I drove to my hotel at St. Helier with the bottom of my wagon covered with Black Hamburg grapes, some of the bunches weighing over two pounds. There is something very charming about the homes of these Jersey farmers; they are very thrifty. You know here they speak of the Connecticut farmers being about the sharpest of all the New England tribe; in England they speak of being as sharp as a Jersey-man. They have a natural turn for turning an honest penny, but they have an immense bump of thrift; and all about their houses and stables everything is in its place and exquisitely clean. For instance, right along at the back door you

will see two or three pairs of wooden sabots cut out of a small wooden block, and the women, the moment they go out of doors, slip their slippers into these wooden sabots, go to the barn, and the moment they get back to the doorstep they drop them off. In front of the house you will always find the most luxuriant growth of flowers, tastily arranged flowerpots, the lawn neatly trimmed and cut, and the whole surroundings are most charming and tidy. You know their houses, of course, are very old. I was very much struck with one thing—that is, the immense depth of the walls there, eighteen inches to two feet. And here the scarcity of the lumber comes in, so the roofs are mostly thatched. They roof a house differently from what we do. They put across the top lengthwise poles, and set them in the mortar. These poles are like telegraph poles, but not as large as telegraph poles. They come from Norway and Sweden. These are imbedded in the cement, and are from three to five inches in diameter. Then the roof is tiled. You frequently find only one or two windows in their houses—and these are very large—on account of the cost of the window frames; and in almost all of the best houses you find the cement or mortar is plastered right on to the sills themselves, and their floors are of cement. They have a very peculiar method in their real estate transactions—their land tenure. It is like the old feudal system;—they have got a system in effect like that in England at the beginning of the twelfth century. It is really almost impossible to get a clear title to a piece of land. The land changes hands very seldom indeed. If a farmer gets to be old and wants to retire, he rents his farm, goes into the city of St. Helier and leads a very comfortable life, and gets a very handsome income from his farm, and if he has no children it goes to his nearest descendants. They have also those old laws that were in England centuries ago, where certain families are pledged to give the Queen a dozen pullet's eggs every year, or two roosters or a dozen quails.

Those are not now collected in eggs, chickens and poultry, but they are collected in the money value. These families that have these old tithes to pay are very proud of it—it is like an armorial bearing.

MR. HAWES. What is their opinion of Americans?

MR. BURNETT. They are very proud of the Americans—they are proud that their cattle came over and did so well. For instance, in Jersey I have had the greatest honor paid me in the adoption of this premium on bulls. You don't know how set these people are. Take what I have related to you about the using of this old-fashioned plough as an illustration of it. After fifty odd years they simply turned about and changed and adopted this premium list on bulls. I shouldn't have considered it half the compliment in this State, for you are so wide awake to see things. I was told afterwards that if the English had proposed it they would have mulled over it for ten years. They are very friendly, indeed, toward the Americans, but they are quick to observe their characteristics. Mr. Hazard went over there, and in twenty-four hours they knew he wouldn't touch anything that hadn't an escutcheon. He brought home a lot of escutcheons, but he left a lot of good animals there. The people feel very sorely now over the law we have enacted—putting a prohibitory tariff of $50 apiece on cattle. There is a story about Philip D'Ancy that is a very interesting story about the breeding of Jersey cows. This Philip was an English sporting gentleman of leisure who rode to the hounds and kept his place up in very good style; but he was a man who made a business of his leisure and always directed it in certain lines. After being thrown from his horse he was laid up, and as he must do something he made up his mind that he would have the best cows there were; so he bought one or two Suffolk cows, and about 1825 he had a large red Suffolk that gave twenty-two quarts of milk. People came from all around to see this wonderful big cow. While he

was riding out one day he saw a little bit of a fawn-colored cow, and the man said it belonged to Michael Fowler; and Philip said, "What about that cow?" and he said, "That cow belongs to my missus; she'd no more part with that cow than she would with one of her own children." And the result was that D'Ancy looked that cow all over, and although she was a little bit of a bag of bones, she had an udder about as big as his red Suffolk cow; and he went to Michael and he says, "What do you ask for that cow?" "I don't want to sell her," was the reply; "she belongs to Mrs. Fowler; but I'll take twenty pounds for her—that's twice what she's worth." "Well, I'll take her," said D'Ancy. It nearly broke Mrs. Fowler's heart. D'Ancy was making butter for his own use, and the little cow gave only fourteen quarts of milk against twenty-two from the Suffolk; but in one week she made two pounds more butter than the Suffolk. The result was that he sold off all his big cows and began to buy Jerseys. Philip D'Ancy bred entirely for butter, but he also bred certain lines of color. He never would have anything on his place that wasn't a solid color; he gave it away or knocked it in the head. The result was it took him a long time; but when his herd of Jerseys was sold, it brought together the most prominent body of men ever assembled in England; and in June, 1867, (they were sold in October,) he made from fifty cows an average of eleven pounds of butter a week, and a net profit of $100 apiece.

Mr. Brown. Did Mr. D'Ancy keep strictly to the Jersey cattle in breeding his herd?

Mr. Burnett. Strictly.

Mr. Brown. I understood he crossed some with the Guernsey.

Mr. Burnett. The Eurotas may be larger, but Bomba was rather a small cow. I think the climate of this country has done much to improve the size of our Jerseys. My own herd of twenty-seven animals averaged over a thousand pounds apiece, and my largest

Jersey weighed 1,150 pounds, and gave fourteen pounds butter a week. My father imported in '54 and bred from Mr. Motley's stock imported in '51. My herd is really as large a herd,—I mean by that, in frame and body. I think my cows are larger than Eurotas.

MR. BROWN. They must be larger than any I ever saw.

MR. BURNETT. I think they are.

MR. BROWN. Mr. Codman claimed Guernsey blood in Eurotas and Bomba.

MR. BURNETT. I have heard of it. I will give you a bit of the history of the island. Whenever two families intermarried, up to about 1850, it frequently happened a Guernsey woman married a Jersey farmer. She would take over with her as a part of her dower a Guernsey cow, which she had cared for, perhaps, as a little girl. Till within the last twenty-five years this very frequently occurred. Now, on the two islands the breed is just as distinct and different as any two types of thoroughbreds in this country. There is no communication between the two now.

MR. BROWN. I think that is the way Mr. Codman claimed that there was a cross years ago.

MR. BURNETT. I think there is no doubt of it. The cattle on the island of Guernsey are much larger than on Jersey. I claim from observation that one reason is on account of having bred so much to young bulls on the island of Jersey, and they have also been breeding more from the Brittany cattle. We are often asked to trace the origin of the two different breeds. We go on the coast of France, a distance of only twelve miles from the eastern side of the island of Jersey, and we find the Brittany cattle. They have a good many points that resemble the Jersey, although in color they are mostly black and white. We go a little farther down the coast nearly opposite Guernsey, and in Normandy we find a cow entirely different from the Brittany cow, but one that resembles the Guern-

sey—a large cow something like the Dutch cow. Those are the typical Normandy cows. Mr. Nicol, a Frenchman who has a farm there, has two hundred of these Normandy cows, and gets from them an enormous amount of milk. These islands were evidently part of the mainland a great many years ago, and the cattle identical with those of the mainland. The Jersey is similar to the Brittany and the Guernsey to the Normandy.

Mr. Winsor. I would like to inquire how the breeds compare—Jersey and Guernsey—according to your observation; which excels?

Mr. Burnett. Well, I believe if I was to make butter simply to bring the highest price in the market, and was not allowed to color it, I would want half Jerseys and half Guernseys—the Jerseys for quality of texture, the Guernseys for quality of color. That, backed up with Indian meal and clover hay, would make a butter that would wholesale for fifty cents a pound.

Mr. Hopkins. I think you will convert some of our farmers here to-day to clover hay.

Mr. Burnett. I should like to. I have found that better results to-day can be obtained for the same money from a herd of Jerseys than a herd of Guernseys. I am in hopes this country will do a great deal for the Guernsey breed. A typical Guernsey cow is one of the most perfect dairy animals I have ever seen.

Mr. Hawes. Aren't they more delicate than the Jersey?

Mr. Burnett. Yes, they are. In my three importations I have made this discovery: where a Jersey will acclimate easily in a year a Guernsey will take two years. They are not as rugged and robust, but I don't think a Guernsey is any more likely not to breed than the Jerseys.

Secretary Smith. Mr. President and Friends,—I am very sure we have all listened to the address of Mr. Burnett on what may be called the origin of Jersey cattle with great pleasure, but while we

have listened to him, our thoughts must at times have wandered away to what we may consider a calamity in reference to this very breed of cattle. At an early hour this morning, as you all know, there was destroyed by fire the elegant and spacious barns belonging to our friend Hopkins, together with his magnificent herd of Jersey cattle, numbering in all about sixty-five head. These embraced a family of his own breeding from one common mother, and on which our friend had spent very much time and thought, and looked upon them as household pets. In view of the great loss that Mr. Hopkins has met with, and in which the public has a share, and knowing it to be your desire to give an expression of your feeling in regard to it, I offer the following resolution, keeping in mind that fortunately he does not need our financial aid, yet, like others of us, an expression of our feeling towards him will, no doubt, be gratifying to him :

WHEREAS, This meeting of farmers have learned with sincere regret of the destruction by fire of the barns and contents belonging to Hon. W. H. Hopkins, together with his valuable herd of thoroughbred Jersey cattle ; therefore

Resolved, That we regard it not only as a private loss to Mr. Hopkins but as a great public loss.

Resolved, That we tender to Mr. Hopkins our heartiest sympathy, and desire to express to him our appreciation of the great loss that not only he, but all lovers of thoroughbred stock, has sustained.

MR. HOPKINS. I appreciate very much the resolution that has been passed and the sympathy manifested. It is a heavy loss to me, and I believe a great loss to the community. I have been for twenty years doing my best, with the best information I could obtain, in the breeding of the Jersey cattle, and I felt very much attached to them. I believe they would have been a great benefit to New England. I had got to a point where perhaps next year I should have been able to have disposed of the younger portion of

my herd and still have some left; but they are entirely wiped out. It is rather late in the day for me to renew them, but still I hope somebody else will. I believe in Jerseys. I have had very large milkers and butter-makers. I had three last summer that on ordinary food and in ordinary condition made fifteen and three-quarter pounds in seven days, another eighteen—of the Eurotas family. I believe I had twenty cows at least that under ordinary conditions would have averaged more than Mr. Burnett's standard of fourteen pounds of butter a week, and I would also add, as to the weight of my herd, that I had a number that would weigh more than a thousand pounds.

Mr. Burnett. I think you will find the Jerseys very deceptive in weight,—they have got a big carcass. I very frequently found animals who would weigh over a thousand pounds, when if I had been asked I should have said it weighed nearer eight hundred.

Mr. Hopkins. I had one bull, a year old, that weighed six hundred and sixty-five pounds.

Mr. Daboll. A week ago, this time, as I went down stairs, Mr. Hopkins sat in his carriage, and he looked up to me and said—to give his own words—" I have been looking for a good-looking man to ride home with me." I rode home with Mr. Hopkins, and I haven't enjoyed an afternoon so well for years. I went all through his barn with him and saw his stock—the cleanest barn and the cleanest stock I have seen in a great while; and this forenoon, when I learned of the fire, I could not help dropping a tear for him.

Secretary Smith presented the following resolution :

Resolved, That we recognize in the efforts of Mr. Hopkins to create a model farm and to stock it with such a valuable herd of Jerseys, a great public benefaction, for which he receives our hearty commendation, and we sincerely hope he may again stock his farm and live long to enjoy it.

The meeting then adjourned.

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